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"Eat Meat Not Animals": why clean meat needs to become a reality and factors that contributes to nudge consumers toward its acceptance

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INTRODUCTION

In recent years, vegetarian diets and plant-based substitutes to conventional animal-origin products, such as dairy, eggs and meat have gained stronger appeal and interest, conquering more popularity even among Western consumers, that in comparison with Asian countries, have traditionally followed a diet richer in animal proteins.
Unfortunately, the pace of growth of this trend is hardly comparable with the rate at which the worldwide consumption of meat, that is also the most polluting and environmentally harming food product, is rising and will predictably continue to rise.

The increase in demographics together with the enrichment of developing countries have brought to the consequent increase in the demand for meat that previously represented an elitarian product destinated only to higher income classes.
To keep up with the rapidly increasing meat demand, new technologies have been introduced in the field of farming and gave birth to entities as CAFO's (concentrated animal feeding operations) that has made farming more efficient under an output point of view, producing enormous quantity of meat each year, but at the same time, has enabled practices that harms both animal welfare and environment increasing climate change. Animals, often live in extreme conditions and to prevent infections large amounts of medications such as antibiotics are used with all the negative consequences for human health, first of all antibiotic resistance. In fact, the proximity of different species, condition that is usual in intensive farms, advantages viruses spread and mutation making it even more risky for human health.

This thesis wants to present the potential that the latest innovative solution achieved by the scientific world, clean meat, can have to satisfy the incessant human desire for meat without harming animals, the environment and in the end humanity itself, and how to boost consumer acceptance of this product starting a food culture revolution.

In the first chapter, the thesis outlines demographical and social changes that have brought to the increase of meat demand and explains how the introduction of clean meat can solve many of the problems derived from intensive farming having as well taken into account the opportunities of current market trends.
Clean meat, also referred to as lab-grown meat, cultured meat, synthetic meat or cultivated meat, uses biotechnology to produce meat from animal cells that are able to duplicate themselves and eliminate the need to raise and slaughter millions of animals each year.

The second chapter introduces the concept of nudge, its principles and the importance of collaboration of companies and institutions to drive people toward a more sustainable behaviour and the role of social influences and efforts needed to achieve this goal. In fact, in the context of food, people tend to have more difficulties to approach innovations that involve the use of complex technology and it often happens that in

their decisional process the perceived risk of a new product can make the consumer end up preferring the familiar choice that is perceived as "safe" because known. There is a sentiment of fear and rejection even if the ultimate aim is to have a safer, healthier and more sustainable product. The main barrier to clean meat acceptance that has been detected across many different studies, is the perceived unnaturalness of the product. The thesis argues on this point both, by highlighting the fact that many products consumers buy on a daily basis, are far from the concept of "natural", and this applies as well to conventional meat, and also, by uncovering the concept of "natural" under its emotional and ethical aspect and how it influences consumer perception of food products.
In addition, in a society where animal welfare is acquiring everyday more importance and where there are more owners of domestic animals than ever before, the consumption of meat appears controversial. Clean meat can represent a solution to this situation where the contemporary love for animals and desire for meat creates in consumers the so called "meat-paradox" freeing them from the moral issue of this troublesome behaviour.
The chapter ends with the illustration of a recent study (2019) about consumer acceptance of clean meat in Italy showing, to the extent of the study, surprisingly positive results.

In the third and last chapter, technical aspects of clean meat, as terminology and regulations and how they affect consumer perception, are presented. The importance of terminology related to clean meat has been debated for many years now and in the end, it seems that the most appreciable term is "cultivated meat". The decision to use the term clean meat for the title of this work lays in the book advised me by my supervisor Prof. Sillari, that has been the main inspiration for this thesis "Clean Meat. How growing meat without animals will revolutionize dinner and the world" written by Paul Shapiro. This term in fact, even if enough appreciated by consumers, has generated the discontent of farmers' associations claiming for being disparaging toward conventional meat. The chapter continues with addressing farmers actions and raised issues against clean meat and tries to explain that even if the ultimate goal is to stop conventional meat production, there will be a long transitional period before this happens in which conventional meat will hopefully gain back its "luxury" essence and small farmers will be able to get back on the market without the threaten of CAFO's.
The chapter then discusses the importance of packaging and labelling solutions using as references organic and plant-based products that had success on the market.

The thesis ends discussing ethical concerns around clean meat related both to human nutrition and to animal dignity and ultimately makes an outlook on the main cultured-meat companies playing currently on the market and considers as well opportunities raising from this pandemic situation.

CHAPTER 1

Current situation of environmental and health issues related to animal-production demand given the population growth and developing food trends

1.1 Demographic change and consequential threatens

In the Brundtland report, published in 1987 by the United Nations, the essence of sustainable development is defined as our "duties to ensure that the global life support system is not so damaged that it threatens the capacity of future peoples to meet their basic or intermediate needs."[1]

Today, the conjunction of a rapidly increasing population and the diffusion of several unsustainable habits, is bringing us to a point of no return. Resource scarcity is not an isolated issue as it was in the past, when it was related only to some locations, today it is now a global threat. The evidence is that our planet is starting to have not enough anymore.

Considering for how long the human being has populated planet earth, it is an issue that started to be threatening in relatively recent years, from the beginning of the 19th century.

Going back in the history of humanity, it is reported that at the dawn of agriculture, the population of the world was approximately 5 million. In 8000 years, approaching the 1 A.C. it grew to 200 million meaning an approximately 0.05% rate per year. To achieve the firs billion, we had to wait almost the beginning of the 1800. From then on, the progression has changed radically.

In this respect, in 1796 the economist and sociologist Thomas Robert Malthus proposed that human population number would increase more rapidly than our ability to grow food, and that a huge number of people will face starvation.

He explains that the human population would grow geometrically—1, 2, 4, 8, 16, 32—and that food production would increase only arithmetically—1, 2, 3, 4, 5, 6. [2]

So, it is clear that food production would not keep up with our expanding appetites.

There are 7 billion people on earth today, and the number is predicted to rise to 11 billion by 2100. With 7 billion people there is already one person out of eight that has not enough to eat.[3] This is because our resources are not unlimited but since it is not affecting the majority of the developed world (that for many years now has also been the greatest exploiter) in a very direct way, it is something people and governments have considered for many decades as a "future problem". Climate change and scientific evidences has shown us that

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[1] World Commission on Environment and Development (WCED,1987)

[2] Malthus, Thomas Robert (1798). An essay on the principle of population. London: Printed for J. Johnson, in St. Paul's Church-Yard

[3] Bongaarts, J. (2009). Human population growth and the demographic transition. Philosophical Transactions of the Royal Society B: Biological Sciences, 364(1532), 2985–2990. doi: 10.1098/rstb.2009.0137

unfortunately it is not a "future problem" anymore even though a certain convenient blindness have been experienced on the issue till more recent years.

Overpopulation together with the intensive resource exploitation is the cause of most of our today world's problem and there is no country that will manage not to be affected by it, if it's not affected already.[4]

One of the biggest arguments related to this uncontrolled demographic increase that is discussed nowadays not only among concerned academics but at institutional levels as well[5], is the over exploitation of planet resources with food and drinking water shortage and the pollution produced that will unavoidably get worse as the population will continue increasing and the measures undertaken to restrain the negative consequences of this increase, will not be enough efficient.

Our planet can offer a quality of life comparable to that enjoyed in the European Union to no more than 2 billion people it is clear that with a population of 8 to 10 billion, this will not be possible anymore.[6]

In order to find out the moment when the human impact has started to be (negatively) significant, we can look back to the beginning of the industrial revolution.

Prior to the end of the 18th century[7], human impact was almost irrelevant and the majority of people were living in rural areas, making their living from the harvests of the land. What happened from then on, is that the population growth became much more rapid, citizens started to move toward the cities to work in factories and the use of resources increased thanks to technological developments and innovations. Moreover, the massive move of citizens from rural areas to cities, faced the necessity to enlarge urban areas, restricting the land available for agriculture and in general, for natural resources.[8]

To have an idea in numbers of how this impact could have rapidly raised in the following years, it is useful to compare the 8000 years necessary to reach the first billion with the only 30 years (from 1930 to 1960) necessary to reach the third billion is revealing enough. At the beginning of the sixties, the growth has reached a peak of an annual rate of 2.2 %. [9]

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[4]Toth, G., & Szigeti, C. (2016). The historical ecological footprint: From over-population to over-consumption. Ecological Indicators, 60, 283–291. doi: 10.1016/j.ecolind.2015.06.040; Savage, R. (1993, May 15). Overpopulation and overconsumption: combating the two main drivers of global destruction. British Medical Journal, 306(6888)

[5] "Integrating Population Issues into Sustainable Development", including the post-2015 Development Agenda. Retrieved from https://www.un.org/en/development/desa/population/commission/pdf/48/CPD48ConciseReport.pdf ; Ripple, W. J., Wolf, C., Newsome, T. M., Barnard, P., & Moomaw, W. R. (2019). World Scientists' Warning of a Climate Emergency. BioScience. doi: 10.1093/biosci/biz088; Sadik ,N. (1991) "Population growth and the food crisis" http://www.fao.org/3/U3550t/u3550t02.htm United Nations Fund for Population Activities, New York; Elferink, M., Schierhorn, F. (April 07, 2016). "Global Demand for Food Is Rising. Can We Meet It?". Harvard Business Review, https://hbr.org/2016/04/global-demand-for-food-is-rising-can-we-meet-it

[6] Overpopulation Awareness, https://www.overpopulationawareness.org/en/

[7] Candelone, J.-P., Hong, S., Pellone, C., & Boutron, C. F. (1995). Post-Industrial Revolution changes in large-scale atmospheric pollution of the northern hemisphere by heavy metals as documented in central Greenland snow and ice. Journal of Geophysical Research, 100(D8), 16605. doi: 10.1029/95jd00989

[8] Williamson, J. G. (1990). Coping with city growth during the British industrial revolution. Cambridge, UK: Cambridge University Press.; Berry, B. J. L. (2008). Urbanization. Urban Ecology, 25–48. doi: 10.1017/cbo9780511664892

[9] https://www.un.org/en/sections/issues-depth/population/index.html

However, in more recent years this growth has faced a slowdown as a consequence of the lower fertility rate in more developed regions of the world that compensate the increased life expectancy rate. And if it could be seen as a positive data, it is still not enough.

To have a worldwide picture, it is also interesting to make a distinction in the growth rate by world regions considering differences in fertility rates and life expectancy.

The highest increase recorded from the second half of the 20th century to the 2010 has been in one of the poorest areas of the world, the Sub-Sharan Africa, with an individual increase of 700 million compared to the European numbers that were hardly reaching 200 million. It is evident that more developed countries have an extremely lower fertility rate for several reasons, with education the most influent one.

Having a look to the data from 2005 to 2010 and from 2010 to 2015, Africa has respectively had an increase in population growth of 2.5% and 2.6% and a variation of fertility rate from 4.9 to 4.7.

During the same period of time Europe has faced only a 0.2% and 0.1% of population growth and has a fertility rate of approximatively 1.5.[10] Even with different growth rate and with different fertility rate the total effect is the same and in the developing countries, that are often the most populated, it can get even worst.

Many researches has shown that the more a woman is educated the less children she will bear in her life[11] but despite this fact, the counter-effect is that as education improves, consumption of natural resources per person increases, meaning that, as we get richer, each of us consume more and therefore what could be the positive outcome of a lower fertility rate effect in terms of resource shortage, is compensated.

The number of products we use and pretend to consume every day is not diminishing and so is not depletion of natural resources. Those resources people daily consume for living, as coal, oil and gas are not only limited but are also polluting and therefore are threatening the future ability of the land to produce new resources, especially food with a good nutritional profile that has been directly linked to the overall population health level.

In addition, thanks to new researches and progresses in the technological development, industries started to be able to exploit even more and even faster.

A common feature of every society is that "wealth, or even the prospect of wealth, generates political and social power that is used to promote unlimited exploitation of resources". [12]

This happens especially in the first part of the transition from an undeveloped country to a developed one. Being it true that the more a society is wealthy the more it consumes it is also true that in recent years education

[10] https://www.un.org/en/sections/issues-depth/population/index.html

[11] Osili, U. O., & Long, B. T. (2007). Does Female Schooling Reduce Fertility? Evidence from Nigeria. doi: 10.3386/w13070; Jain, A., & Nag, M. (1986). Importance of Female Primary Education for Fertility Reduction in India. Economic and Political Weekly, 21(36), 1602-1608. www.jstor.org/stable/4376095; Kasarda, J. (1979). HOW FEMALE EDUCATION REDUCES FERTILITY: MODELS AND NEEDED RESEARCH. Mid-American Review of Sociology, 4(1), 1-22 www.jstor.org/stable/23252607; Ahmed, R. (2010). Impact of Female Education on Fertility in Developing Countries. Pakistan Journal of Education, 27(2). doi: 10.30971/pje.v27i2.139

[12] Ludwig, D., Hilborn, R., & Walters, C. (1993). Uncertainty, Resource Exploitation, and Conservation: Lessons from History. Ecological Applications, 3(4), 548-549. www.jstor.org/stable/1942074

and development in richest countries have brought to a higher level of consciousness and concerns about the effects of our actions on the environment.

In fact, at the beginning of the industrial revolution, during those early stages, natural resources were leveraged without any regard and without concerns, and environmental pollution has increased rapidly since the main focus was the achievement of the output and the technological improvement was considered only as a mean by which achieve this output in a more massive amount and in a shorter period of time. The consequence of this behaviour is that today, we are living beyond our means.

So, in order to contain this raising "exploiting" trend, governments of countries with a higher economic level and consequently with higher education level, couldn't ignore the problem anymore and started to try acting more efficiently and take adequate measures in order to increase the environmental protection without reducing the material output that is required by the population. Alternative sources of energy as solar, wind and electricity are trying to compensate rising requests and reduce pollution, but it still has a too far modicum role in the general context of industries.

When it comes to exploitation and natural resource pollution it is necessary to consider the role and the impact that industrial food production has. The food supply is a major cause of greenhouse gas emissions, unsustainable water extraction and pollution, deforestation and biodiversity loss that in return have negative effects on human well-being.[13] Agriculture makes the heaviest contribution to the general impact both in developed countries and, in proportion, even more in developing countries. In addition, as an indirect consequence, the deforestation caused by the need of free land for agriculture production causes the releases of CO2 into the atmosphere, and adds a further 6-17% increase in total pollution. Summing up all the direct and indirect impacts it has been estimated that the agriculture total contribution to global emissions reaches 30% rate.[14]

Our eating habits have been involving every year more kilograms of meat per person and meat production is not only resource consuming, but also waste producing and among all food products, meat is the most polluting product to produce. Moreover, it was estimated that if the population will continue to increase at this rate, by the 2050 the demand for livestock products will growth by 70%, which is clearly unsustainable since also the general production of food will need to increase to this rate putting additional pressure on the already high pollution and stressed water resources. Water resource is as well necessary to satisfy global energy demand that is expected to rise by 60% in the next 30 years.[15]

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[13] World Health Organization. (2005). Ecosystems and human well-being: health synthesis: a report of the Millennium Ecosystem Assessment / Core writing team: Carlos Corvalan, Simon Hales, Anthony McMichael ; extended writing team: Colin Bulter ... [et al.] ; review editors: José Sarukhán ... [et al.]. Geneva: World Health Organization. https://apps.who.int/iris/handle/10665/43354

[14] Bellarby, J., Foereid, B., Hastings, A. F. S. J., & Smith, P. (2008). Cool Farming: Climate impacts of agriculture and mitigation potential. Amsterdam, Netherlands: Greenpeace International

[15] Gerber, P.J., Steinfeld, H., Henderson, B., Mottet, A., Opio, C., Dijkman, J., Falcucci, A. & Tempio, G. 2013. Tackling climate change through livestock – A global assessment of emissions and mitigation opportunities. Food and Agriculture Organization of the United Nations (FAO), Rome. http://www.fao.org/3/a-i3437e.pdf; Jägerskog, A., Jønch Clausen, T. (eds.) 2012. Feeding a Thirsty World – Challenges and Opportunities for a Water and Food Secure Future. Report Nr. 31. SIWI, Stockholm.

The pollution from livestock is not coming only directly from the animal farming but also from the involvement of agriculture in the process, since it is necessary to produce the feed for the huge amount of animals raised. Livestock is also source of water pollution and the predicted increase in irrigation water in the next decades is attributable to the increasing production of animal feed.[16]

In fact, the reason why meat production is so threatening for our planet it is that it is very inefficient since the high involvement needed of agriculture and its footprint and considering that at the end of the process only 50% of the whole animal is fit for human consumption.

Therefore, whether we can grow enough food sustainably for an expanding world population presents an important challenge: where, at the current conditions, will food for an additional 2 to 3 billion people come from if we are already struggling to feed properly those actually existing 7 billion? And furthermore, considering the eating habits in the developed world, that are largely animal-based, and the rising trends in developing countries that are following the same path, it is clear that we need more alternatives available before it's going to be too late.

So, having established that not only we will grow by the number of individuals but also that the general income level will increase all around the world and being aware that income is a driving factor for a more animal oriented diet, caring about how to make our food system sustainable is an urgent issue to deal with.

At the current pace, on one side, industrial food will become cheaper and it is already available worldwide thanks to the possibility to move it through long distances quiet cheaply, and on the other side, expensive food as meat, that once was a privileged meal that only a small portion of people could enjoy, becomes more affordable even in developing countries that traditionally were used to a plant-based diet.

In fact, nutritional transition is the direct consequence of economic and social changes and it occurs, even if at different rate, at every income level.

1.2 Enrichment of the developing countries and food habits in different world regions

There are several factors that influence the nutritional habits of a population and the difference between countries. Cultural and economic level are the most important.

The general increase in the consumption of ultra-processed foods that are high in sugars and fats all around the world, and also in countries that originally had a "healthier" diet full of fibre-rich vegetables has been possible due to the worldwide expansion of global food and beverage companies. The economic growth of countries as China has led to a radical change and in the Asian country, the increase of processed food has been growing at the rapid rate of 50% per year. [17]

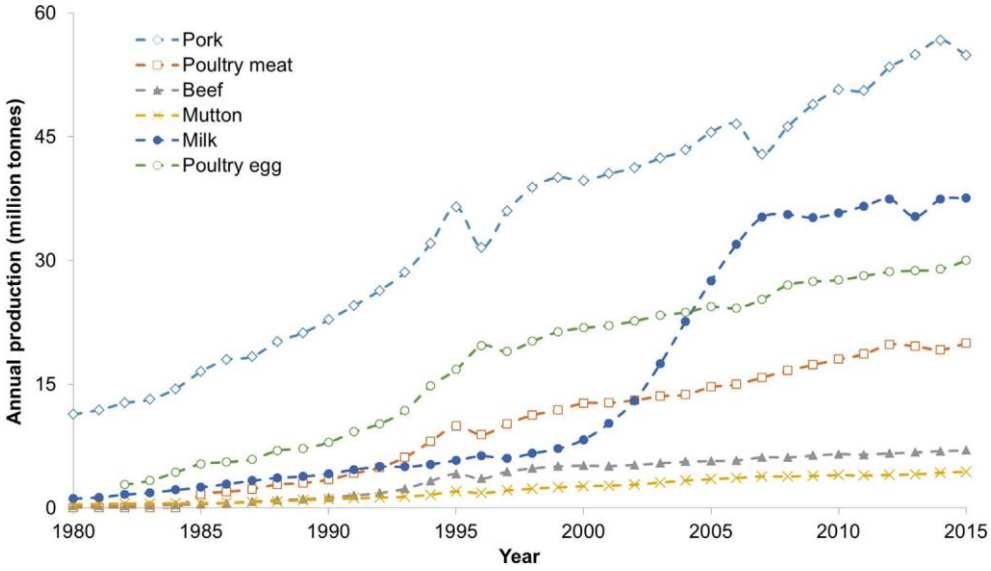
The dietary pattern has changed also for what it concerns animal product consumption. In fact, not only in developed and wealthy countries people are consuming more animal product. In 2003 it was registered that

[16] FAO (2006) Livestock's Long Shadow. Rome: Food and Agriculture Organisation. http://www.fao.org/3/a0701e/a0701e.pdf

[17] Zhou, Y., Du, S., Su, C., Zhang, B., Wang, H., & Popkin, B. M. (2015). The food retail revolution in China and its association with diet and health. Food Policy, 55, 92–100. doi: 10.1016/j.foodpol.2015.07.001

from the beginning of the 1970 to 1995 consumption of meat in developing countries increased almost triple the increase in developed countries, and consumption of milk increased more than twice the increase that occurred in developed countries. Despite having a millenary history of vegetarianism due to their cultural and religious motivations this doesn't stop them from making the meat consumption skyrocket in the latest years. Two of the nations that experienced this shift are China and India.

China and India are also among the most densely inhabited nations and they have undergone a rapid economic growth that, together with globalizations has allowed to many citizens to go for a more western diet, rich in meat, dairy and eggs. To satisfy the demand, the supply needed to grow. So, from the 1980 factory farms started to expand and being relatively new to the practice, environmental harm and animal welfare where not at the top of their priorities.



Growth in the supply of animal food products in China between 1980 and 2015 (data from National Bureau of Statistics, http://data.stats.gov.cn/index)

This changing trend toward a more western diet, has also impacted on health diseases' spread among the population that formerly haven't shown a high occurrence. In China nutrition-related diseases such as obesity and cardiovascular illnesses has raised with the raise of meat and fat consumption that followed the economic growth. Specifically, there has been a considerable increase in processed food that, even if till now represent only a small portion of the Chinese diet, has the worst impact on health.[18]

When it comes to pollution livestock consume a lot of drinkable water and it is something that in some regions of those countries is just unsustainable. Producing animal products is much more inefficient than plant-based product considering the amount of plant-based products necessary to feed the livestock. For example, it's

[18] Burggraf, C., Kuhn, L., Zhao, Q.-R., Teuber, R., & Glauben, T. (2015). Economic growth and nutrition transition: an empirical analysis comparing demand elasticities for foods in China and Russia. Journal of Integrative Agriculture, 14(6), 1008–1022. doi: 10.1016/s2095-3119(14)60985-0

impressive to consider that the amount of grains fed to US livestock is sufficient to feed about 840 million people who follow a plant-based diet.[19]

It is estimated that 89–97% of gross energy contained in the feed and 80–96% of all protein in cereal and leguminous grains fed to animals are not converted to edible protein and fat. [20]

The change in climate is already too great and the water utilization too massive.[21]

The water amount required is one of the biggest consequences of livestock farming. Especially in some regions of India and China the safety systems[22] of factory farms are not ensuring the standards required to prevent water contamination and in terms of water footprint it is estimated that the total water footprint of pork (as litres per kcal) is two times larger than the water footprint of pulses and four times larger than the water footprint of grains and that one thousand single-gallon jugs of water is needed to have the meat of just one chicken.[23]

If it is possible to be hopeful and optimistic about the more developed countries to start using less intensive resource-consuming methods to produce food, in countries that have only in recent years faced the major development it is probably not something that will face substantial improvement in the very next period even if developing countries are the most populated of the world and the need to find suitable solutions is even more urgent there than in other countries.

The awareness and consequent consideration of environmental health is something that comes when a country has levelled off a certain life standard under a social and economic point of view, and has the resources to invest not only in producing but in producing without harming. Therefore, in developing countries it is necessary to speed-up this consciousness acquisition in order to limit the negative effects. Otherwise, it is probable that it will face the same pattern that have manifested with biomass fuel consumption. Thanks to innovation, in developed countries there has been a shift from the use of biomass fuel to petroleum and electricity. What was registered in developing countries is that even if cleaner fuel where available, the majority of households continued to use simple biomass fuels.[24]

So, this reveals that human impact on the environment is not only an issue of availability but often it is about education and acknowledgment of certain issues. In poorer countries where the consumption of meat has been for long periods linked to an individual's wealthiness, and that was for many years prohibitively expensive,

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[19] Pimentel, D., & Pimentel, M. (2003). Sustainability of meat-based and plant-based diets and the environment. The American Journal of Clinical Nutrition, 78(3). doi: 10.1093/ajcn/78.3.660s

[20] Smil, V. (2002). Worldwide transformation of diets, burdens of meat production and opportunities for novel food proteins. Enzyme and Microbial Technology, 30(3), 305–311. doi: 10.1016/s0141-0229(01)00504-x

[21] "Water Scarsity". United Nations. https://www.unwater.org/water-facts/scarcity/

[22] Lam, H.-M., Remais, J., Fung, M.-C., Xu, L., & Sun, S. S.-M. (2013). Food supply and food safety issues in China. The Lancet, 381(9882), 2044–2053. doi: 10.1016/s0140-6736(13)60776-x

[23] Gerbens-Leenes, P., Mekonnen, M., & Hoekstra, A. (2013). The water footprint of poultry, pork and beef: A comparative study in different countries and production systems. Water Resources and Industry, 1-2, 25–36. doi: 10.1016/j.wri.2013.03.001; Mekonnen, M. M., & Hoekstra, A. Y. (2012). A Global Assessment of the Water Footprint of Farm Animal Products. Ecosystems, 15(3), 401–415. doi: 10.1007/s10021-011-9517-8

[24] World Health Organization. (2000). Indoor air pollution in developing countries: a major environmental and public health challenge. Bulletin of the World Health Organization., 78. https://doi.org/10.1590/S0042-96862000000900004

for this behavioural pattern to change there is still a long way to go and it is also totally understandable that considering how long it took them to achieve this new wealthiness, now they are not willing to sacrifice it. It is therefore necessary to find an efficient alternative.

This controversy between the need of an increased food production and the need to save resources is something well-known at institutional levels. There is this controversial situation where, from the creation of the United Nation several treaties have addressed the issue. On one hand, environmental treaties concerning food production have been signed. In 1992 the United Nation Framework Convention on Climate Change was signed by 154 nations with the objective to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous human interference with the climate system and it was the starting point to the production, in 1997, to the even more impactful Kyoto Protocol in which were established legal obligations for developed countries to reduce their greenhouse gas emissions between 2008 and 2012. In 1992 another treaty was signed, the Biological Diversity with the objective is to develop national strategies for the protection of biodiversity and a sustainable use of its components. On the other hand, there are other needs, the most pressing is the urgency to reduce world hunger and malnutrition, that set the necessity of a further expansion since with hunger no development is possible and the human capital is fundamental for any progress. So, to manage those need discrepancies there are also some sort of mitigation as the one given by the Millennium Ecosystem Assessment that promotes the use of agricultural practices that increase the output of food generation without the harmful effect of water, nutrients or chemical substances that also in developed countries are still highly used and in less wealthy countries is notably even harder.

As a matter of fact, even if in prosperous countries, despite the acknowledgment about health and environmental concerns and an emerging trend toward a plant-based diet for health and ethical related reasons, it is still a minority that is too small in order to have a significant impact. In almost 10 years, from 2006 to 2017, the amount of meat eaten per person in America decreased from 100 kg to 97 kg but the US still remain the largest meat eaters on the planet. On average, Americans consume 20 more kg of meat per year than they did 50 years ago and in affluent countries, the protein intake is generally larger than required, particularly due to the excessive consumption of animal products.[25]

Europe is not much more virtuous, since 16 % of the total production of meat has been estimated to occur in the European Union with an amount per person of around 52kg a year with an increase of around 50% from the 1960 to 2007.[26]

Furthermore, even switching to a completely plant-based diet will not be sufficient to avoid food scarcity and environmental damages since, as mentioned above, agriculture is very polluting and the rate at which it is possible to grow fruits, vegetables and seeds will not keep pace with the raising demand of the growing

[25] Challenging Concentration of Control in the American Meat Industry. (2004). Harvard Law Review, 117(8), 2643-2664. doi:10.2307/4093409

[26] FAO. (2010). FAOstat consumption data. FAO

population and that the treatment applied to the land to obtain yields will be leading to significant losses of terrestrial biodiversity.

For what it concerns Northern America and Europe, an important factor has been the strong diffusion of communications about all the low-carb diet fashion that had a wide spread out in the last three decades.

Trends as the KETO diet, the PALEO diet and others have convinced a lot of people, especially the more fitness-oriented that proteins (especially animal proteins) are good and necessary meanwhile carbs are "bad". Even though this concept has been disproved by many scientific studies, it is still very popular choice. Moreover, it was registered that there is the perception that a plant-based diet is unbalanced and poor in protein and iron. [27] This was registered as one of the most influencing barriers when it comes to changing someone's diet, especially among women.

However, the reality we are facing is that it is useless to wish that people will radically change their eating habits and everyone will switch to a plant-based diet, since it is obviously unrealistic and changing consumption patterns is a slow cultural process. What is necessary, it is to find an alternative of how to supply the animal product request without continuing to consume so much resources and creating a such huge amount of wastes in the meanwhile.

If it is not possible to rely on consumers common-sense and ethical reasoning, it is possible and necessary to give them an alternative that will satisfy their taste, nutritional and emotional needs.

1.3 The rise of CAFOs and its consequences: ethical and safety matter and the Clean Meat alternative

Till the beginning of the 20th century, in farms, wide variety of vegetables, fruits and seeds were cultivated and different species of animal were raised.

Today, it would be very difficult to find a farm with these features and what we will look at will probably be a huge farm producing only one or two kind of products, most probably corn and soybeans.

When the Great Depression hit the U.S.A. family-run farms were spread all over the country. The economic crisis made people consume less and this generated a food production surplus that led to a fall in crop prices often under their costs of production making it unsustainable for farmers. So, the government redacted the first Farm Bill in 1933 to help the farmers. It was a program that was establishing a target price for each specific crop. If the crop price dropped below the target price farmers could use this crop as a guarantee and acquire a loan from the government. In this way farmers could store the crop until the market situation improved and sell it, repaying the government or if the market remained low, leave the crop to the government's federal granary to repay the loan. This brought to an initial stabilization of food price and supply but it was an artificial support.

Getting to the middle of the century modern technology permitted the development of products such as pesticides and agricultural mechanization that created overproduction and again a big depression of crop price.

[27] Lea, E. J., Crawford, D., & Worsley, A. (2006). Public views of the benefits and barriers to the consumption of a plant-based diet. European Journal of Clinical Nutrition, 60(7), 828–837. doi: 10.1038/sj.ejcn.1602387

This time the government didn't intervene and allowed large farmers that were still a minority, to exploit smaller farmers by purchasing them at below-market rates and joining other large farms and food processors to create the first agribusiness lobby. Those agribusinesses had support from government farm policies especially during Nixon presidency when the secretary of agriculture Earl Butz claimed that farmers needed to "get big or get out". In this period agricultural policy started relying on farm subsidies. From 1970 to 1986, direct government payments to farmers increased from $3 billion dollars a year to $26 billion dollars a year.[28]
Because of its appreciable features such as the high yields per input, a wide variety of uses and the ability to being stored, corn production has been receiving a preferred status in US agriculture policy and at the end of the 19th century, corn became a primary ingredient in feeding livestock.[29]
But since the cattle's digestive system is not designed to consume corn it become necessary the use of massive doses of antibiotics and other medications.
Together with the enlargement of the farms, advances in mechanical and medical innovations for treating and feeding the livestock, there was a rise in efficiency of production in terms of quantity, that made it possible to reduce the price for consumers, making meat and dairy more accessible and more consumed than ever-before.
The development of farming techniques brought to the diffusion of AFOs (animal feeding operation) that are considered CAFOs (concentrated animal feeding operation) when it has a certain type and number (high-density) of animal and when it presents a certain discharge waste in the water supply. If it is true that it is possible to produce high amounts of animal products with this kind of structures, one of the biggest concerns of this kind of farms is the potential risk of contamination of land, air and groundwater, with around 150 pathogens, as E. coli and Salmonella, from manure. Substances as nitrogen and phosphorus, or growth hormones and antibiotics used to avoid several diseases that the animal can have when living very close one to the other, can have consequences for human and environmental health, generating antibiotic-resistance and unfertile soil. In fact, if at low levels antibiotics in feed can help the animal to grow faster, produce more meat and avoid illness it is true that more than half of those antibiotics are the same used by humans. On the other side, not using antibiotics in CAFOs exposes to the risk of developing novel kind of viruses that through mutation events can result in human-to-human transmission.
It's not surprising that factory farms elevate the risk of new viral outbreaks.
When animals are crowded in close confinement, as it would happen for humans in similar conditions, it can cause stress which supress their immune system making the animals more at risk for infection and the close contact facilitates the transmission of those infection. Moreover, when different species are in close contact it is a benefit for any kind of virus since it gives it the opportunity to mutate and create new strains that are more difficult to detect and cure which is an incentive to the unavoidable use of antibiotics.

[28] Melanie J. Wender, Goodbye Family Farms and Hello Agribusiness: The Story of How Agricultural Policy is Destroying the Family Farm and the Environment, 22 Vill. Envtl. L.J. 141 (2011)
[29] https://foodprint.org/blog/corn-factory-farming-and-the-global-economy/

Discussing the pollution aspect of the matter, it is well-known that large farms can produce more waste than some cities. Furthermore, there are many farms that are not producing their own feed and cannot use the manure they produce as fertilizer and so they practice ground application that has the lowest cost but present the risk of overloading the land with nutrients and contaminating the groundwater that is the major source of drinking water.

The U.S.A. EPA (Environmental Protection Agency) data shows that states with many CAFOs have on average 20 to 30 water quality problems per year as a result of manure management issues. Moreover, for people living in the nearby of those farms, children have a higher risk of developing asthma because of the gaseous emissions from the decomposition of manure. [30]Also, psychologically, the odours produced can have a heavy impact on the lives of individuals living in the surroundings. Families can start avoiding to open the window, even with hot temperature and without air conditioning devices, avoiding to let their children play outside and many other lifestyle changes that negatively impact people mental health with highest rate of depression, anxiety and stress. So, it is one of the examples that proofs how quality of life is directly and highly affected by one of our means to produce food.

In addition, feeding those amounts of animals that are fed and raised exclusively for being slaughtered after few weeks or few years and then eaten, request enormous amount of plant resources that not only are resources that are taken from our "dishes" but that are causing massive deforestation of the rainforest, that ensures us breathable air. For example, soybeans are not used only to produce soy milk, tempeh, tofu or any other fancy vegan alternative for human consumption, its main production is destinated to animals and its production needs massive amounts of land. In the EU, about two thirds of the total agricultural area is used for livestock production. The EU livestock maintenance annually needs around 500 million tonnes of animal feed and about 40% of this quantity is in grass and 28% in cereals. From all the cereals produced in Europe, 60% is used in animal feed which is an enormous amount considering the amount of water, land and resources need to produce it. Furthermore, around 12 million hectares of land outside Europe, especially in Amazonia, is used to produce soybeans from which protein-rich feeds are produced for European livestock.

It is not something that affects only CAFO's since "these stark inefficiencies remain regardless of whether we're talking about local, organic, non-GMO, or other buzzwords often labelled on animal-product packaging". [31]

Having considered all of the problems that growing a number of animals that produce enough meat for meeting the current population's dairy, egg and meat demand, it is clear that, a part from monitoring those entities through severe regulations and controls, it is necessary to find a way in which the existence of such realities will not be necessary anymore.

[30] Pavilonis, B. T., Sanderson, W. T., & Merchant, J. A. (2013). Relative exposure to swine animal feeding operations and childhood asthma prevalence in an agricultural cohort. Environmental Research, 122, 74–80. doi: 10.1016/j.envres.2012.12.008

[31] P. Shapiro (2018), Clean Meat. How growing meat without animals will revolutionize dinner and the world. Gallery Books

There are two important alternatives to conventional meat. The first one is plant-based meat and is already on the market with some top products as the Beyond Meat brand is able to produce. Those products have been appreciated in taste also among meat-eaters. The other, that has an even higher potential in terms of sustainability, is cultured-meat or so called "Clean Meat", that is hoped to be in the market in the near future. Both seems ideal substitute to combat the resources' shortage and the animal cruelty involved in meat production without making consumers to renounce to their favourite source of proteins.

Cultured meat would involve 45% less energy, 99% less land and 96% less water than conventional meat.[32]

Imagining of having the opportunity to produce meat, meaning real meat not only some kind of a carrot and bean burger, but without all the animal sufferance and exploitation, without all the water wasting, without the gas emissions and without the need to use antibiotics and other medications to avoid the proliferation of pathogens and viruses seems the natural solution. If it will be possible to consume a steak or a chicken breast that was produced without all the health risks, the ethical issues and the environmental harm that the conventional animal-product producing request, it is clearly destinated to be part of our future diet.

This is something not necessarily meant for vegetarians, that will probably stick to their plant-based diet, but for all those people that enjoy meat, consume meat and have no intentions to abandon it, but are aware of what all of us are sacrificing to produce it in the conventional way.

The consciousness of the consumer of having the possibility to do something good for the planet and for him itself thanks to the advance in technology, is the key to achieve this result.

In 1932 Winston Churchill had already commented "Fifty years hence we shall escape the absurdity of growing a whole chicken in order to eat the breast or wing by growing these parts separately under a suitable medium".[33] And it makes perfect sense. When an animal is raised, you have to feed it to make grow the whole animal, all parts of it, and obviously there are many parts of the animal that will never be eaten. So, basically, we are investing nutrients, water and land for something that will be thrown away.

What technology is permitting today is to avoid this. Clean meat is a cultured meat, it means to culture the cells of the and grow meat or produce leather outside of the animal. It uses technologies that were firstly developed for the medical field specifically in regenerative medicine and are currently used worldwide for treating different kind of diseases. For example, for diabetic patients, insulin is produced with the same biotech process and in many surgery procedures it is a regular practice to take a patient skin cell, and culture it in order to re-create real human skin that is exactly the same as the one of the person. Moreover, even in food production culturing is not a novel technique, if we think of beer or yoghurt those are specific yeasts and bacteria that are being treated with specific process to multiply themselves and create the final product.

[32] Tuomisto, H. L., & Mattos, M. J. T. D. (2011). Environmental Impacts of Cultured Meat Production. Environmental Science & Technology, 45(14), 6117–6123. doi: 10.1021/es200130u

[33] Goodwin, J.n., and C.w. Shoulders. "The Future of Meat: A Qualitative Analysis of Cultured Meat Media Coverage." Meat Science, vol. 95, no. 3, 2013, pp. 445–450., doi:10.1016/j.meatsci.2013.05.027.

The first cultured hamburger was produced and eaten in 2013 in London, thanks to the funding of the Googles co-founder Sergey Brin to the Chief Scientific Officer Professor Mark Post project[34]. Mark Post, professor of vascular physiology at Maastricht University decided to found the Mosa Meat start-up company together with Peter Verstrate in 2016, who has a background in the processed meat industry, and the team of scientist and technicians that developed the first cultured-burger. The production process of a piece of "clean meat" or, "in vitro meat", is described in detail by Post: "The first step is to take some cells from the muscle of an animal, such as a cow if we're making beef, which is done with a small biopsy under anaesthesia. The cells that are taken are called myosatellite cells, which are the stem cells of muscles. The function of these stem cells within the animal is to create new muscle tissue when the muscle is injured. It is this inherent talent of the stem cells that is utilised in making cultured meat. The cells are placed in a medium containing nutrient and naturally-occurring growth factors, and allowed to proliferate just as they would inside an animal. They proliferate until we get trillions of cells from a small sample. When we want the cells to differentiate into muscle cells, we simply stop feeding them growth factors, and they differentiate on their own. The muscle cells naturally merge to form "myotubes" (a primitive muscle fibre that is no longer than 0.3mm long). The myotubes are then placed in a gel that is 99% water, which helps the cells form the shape of muscle fibres. The muscle cells' innate tendency to contract causes them to start putting on bulk, growing into a small strand of muscle tissue. From one sample from a cow, we can produce 800 million strands of muscle tissue (enough to make 80,000 quarter pounders). The meat can then be processed using standard food technologies, for example by putting them through a meat grinder to make ground beef." [35] Back in 2013 the production of that one burger cost $330.000.[36] The work of the scientific world involved in this mission is aimed to the cut of the costs to a $11 per burger which would made it even more affordable than some conventional burgers and in 2017 they've had already managed to cut it by 80% of the initial cost.

When the burger was tested and tasted at the event by two authorities on food, Josh Schonwald, awarded journalist and author of "The taste of tomorrow", and Hanni Ruztler, an Austrian nutrition scientist focused on future food trends, it resulted enough similar to the taste of a burger but there where some issues with the texture. This was not surprising since the meat tasted had no fat, as the normal patty would do, and no blood. In further development several additions to enhance the texture were adopted. For example, fat additions were experimented with the benefit that it is possible to add healthy sources of fats such as omega 3, that are better for the heart condition, as opposed to the saturated fats and dietary cholesterol that can be in dangerously high amounts in meat and is linked to strokes and obesity. Also, other solutions as the use of beet juice to mimic the bloody effect of real meat were improved.

[34] Henry Fountain (5 August 2013). "A Lab-Grown Burger Gets a Taste Test". New York Times. https://www.nytimes.com/2013/08/06/science/a-lab-grown-burger-gets-a-taste-test.html

[35] "How it's made". Mosa Meat. https://www.mosameat.com/technology

[36] Bhat, Z. F., Kumar, S., & Fayaz, H. (2015). In vitro meat production: Challenges and benefits over conventional meat production. Journal of Integrative Agriculture, 14(2), 241–248. doi: 10.1016/s2095-3119(14)60887-x

Next it was the Memphis Meat, founded by the leading cardiologist Dr. Uma Valeti and a former poultry farmer now vegetarian cell-biologist, to pursue the intent of commercialization. Till then, all others' efforts, including the one of Mark Post, have focused on academic research and realization. The Memphis Meat produced the first-ever lab-created meatball with the "incredibly low" cost of 1200 dollars, that in comparison with the 330.000 dollars of the Post's burger was a great achievement and made the dream of animal meat-free world a big step closer.[37]

In 2017 the company was able to shift from beef meat to poultry[38], that is the most consumed meat worldwide, and the cost of the meatball production have halved.

Under a commercial point of view the most desirable perspective is that it would be the heads of national and international meat companies to decide to join this new business opportunity and there is already some of them investing is clean meat start-ups.

Cargill, one of the American largest meat producers, in 2017 has been the first conventional meat business to invest in a cultured meat start-up, Memphis Meat and made further investments in 2020. The company has also invested in an Israeli cultured-meat start up in 2019, Aleph Pharms, and in 2020 in the plant-based market announcing to create an owned plant-based meat brand. [39]Also, Tyson food, in 2018 invested both in the Israeli cultured-meat start-up "The Future of Meat" and in the American "Memphis Meat", and in 2019 started investing and producing their plant-based meat brand in 2019.[40] Other important personalities from the innovation industry such as Bill Gates, joined the culture meat initiative with important investments in the business creating a trustworthy effect. [41]

An issue that has been raised is, whether this kind of production will start spreading in the market is what about all the farmers that are making their living from the livestock and have the land where the animals and the feed is produced. The simplest answer to this question is also probably the most real. It is something that will face a transition, and the land can be used to produce something different as it happens when consumers showed interest in other products in the past, and the job of the farmers will undergo an evolution just as it happens in other professions.

When companies such as the Beyond Meat and Impossible Foods have started to produce their products there were many sceptics that such product will have the desired resonance. Today, products such as the Beyond Burger is sold in American mainstream supermarkets and when compared with the first plant-based

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[37] P. Shapiro (2018), Clean Meat. How growing meat without animals will revolutionize dinner and the world. Gallery Books

[38] Memphis Meat. https://www.memphismeats.com/about

[39] Watson, E., (August 23, 2017). "Cargill and other 'food industry giants' join $17m funding round for clean meat co Memphis Meats". Food Navigator. https://www.foodnavigator-usa.com/Article/2017/08/23/Cargill-joins-funding-round-for-clean-meat-co-Memphis-Meats; Nelson, A., "Cargill invests in cultured meat company Aleph Farms". Cargill. https://www.cargill.com/2019/cargill-invests-in-cultured-meat-company-aleph-farms

[40] Tyson Foods. (January 29, 2018). "Tyson Foods Invests in Cultured Meat with Stake in Memphis Meats". https://www.tysonfoods.com/news/news-releases/2018/1/tyson-foods-invests-cultured-meat-stake-memphis-meats; Lucas, A., (October 10, 2019). "Lab-grown meat start-up raises $14 million to build production plan". CBNC. https://www.cnbc.com/2019/10/10/future-meat-technologies-a-lab-grown-meat-start-up-raises-14-million-dollars.html

[41] Friedman, Z. (August 25, 2017). "Why Bill Gates And Richard Branson Invested In 'Clean' Meat". Forbes. https://www.forbes.com/sites/zackfriedman/2017/08/25/why-bill-gates-richard-branson-clean-meat/#7b1817e9af27

alternatives to meat, the improvement in taste and texture have reached incredible levels and is appreciated also among meat-eaters.

Those products as the Impossible burger are not simply made out of vegetables, there are several technological processed involved, one of the most impressive is the use of a genetically engineered yeast process that makes the heme, in iron rich molecule, that can be extracted from soybeans and that forms the "blood" in the burger and actually turns brown when cooking.[42] People are already consuming food that can be considered a technological product, therefore why not be optimistic about the chances of clean meat.

Innovation is necessarily happening in every aspect that involves the human being, since humanity is made to evolve and find suitable solutions to adapt to new conditions, and the new conditions (overpopulation and over meat consumption) are already there.

1.4 The plant-based market: consumers' perceptions and retailers' opportunities

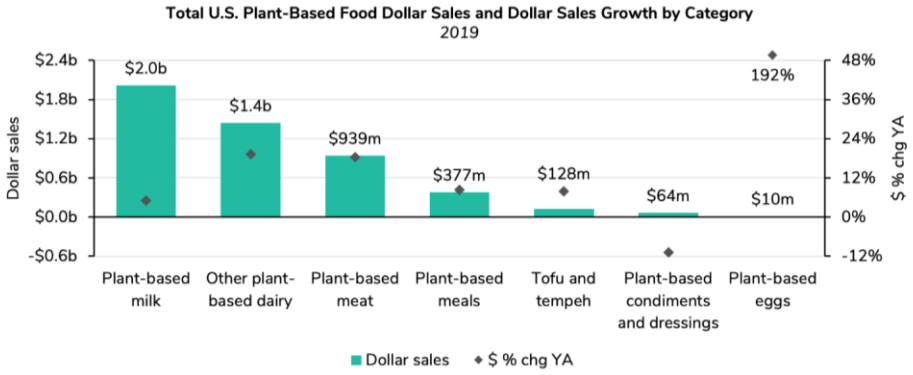
The plant-based food market is in continuous expansion.

The popularity of products that don't involve the use of any animal source have raised not only among vegan or vegetarians, that previously had much less options for their diet, but also around omnivore individuals that are becoming more aware about the environmental and health impact of a heavily animal-based diet. People are more interested in what they eat, and products such as the functional foods that are known for being rich in antioxidants, omega, minerals and vitamins are starting to be part of people's daily diet, in the expectation of a healthier, longer and more productive life. At the same time people are more aware of the negative effects a heavy meat diet can make arise and try to balance it out searching for some alternatives driven why a progressive shift in their values.

The Good Food Institute, a leader no-profit organization that promotes plant-based alternatives enhancing the collaboration between scientists, entrepreneurs and institutions and actively supports companies that produce plant-based substitutes to animals' products, has recorded that today, the plant-based market is worth 5 billion dollars in the U.S.A with an increase of 29% in the retail sales in the last two years with plant-based milk as the most established category.[43]

[42] P. Shapiro (2018), Clean Meat. How growing meat without animals will revolutionize dinner and the world. Gallery Books

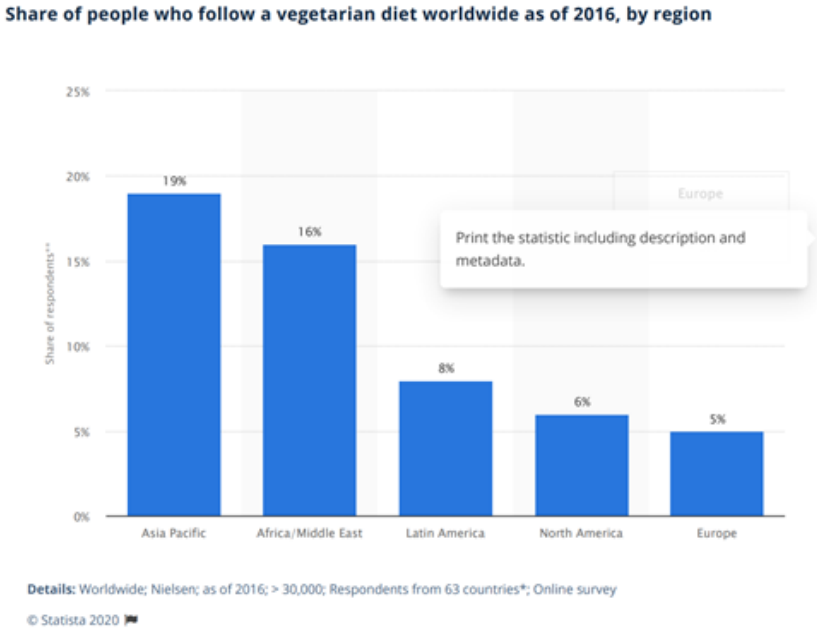
[43] "Plant-Based Market Overview". The Good Food Institute. https://www.gfi.org/marketresearch



This clearly demonstrate a rising trend that shows how consumers' preferences are changing and how retailers in order to benefit from this new expanding segment have to respond to this increasing demand offering a new variety of products and giving the category a larger shelf-space.

However, even if vegetarianism has always existed, only in recent years it started to be a studied concept in terms of people's attitudes and preferences.

Currently the number of people switching for a plant-based diet despite the evidences of contribution of livestock production to environmental issues[44], even if growing, is still relatively moderate and there are several reasons that are keeping people away from changing their attitude that should be considered, in order to create well designed promotion that will bring an increasing number of consumers toward a behavioural change that when it comes to food is a delicate matter to approach. [45]



Nielsen. (August 30, 2016). Share of people who follow a vegetarian diet worldwide as of 2016, by region [Graph]. In Statista., 2020, https://www.statista.com/statistics/597408/vegetarian-diet-followers-worldwide-by-region/

[44] Laestadius, L.I., Neff, R.A., Barry, C.L. et al. Meat consumption and climate change: the role of non-governmental organizations. Climatic Change 120, 25–38 (2013). DOI 10.1007/s10584-013-0807-3

[45] Hrynowski Z. (September 27,2019). "What Percentage of Americans Are Vegetarian?". Gallup News. https://news.gallup.com/poll/267074/percentage-americans-vegetarian.aspx; Bhat, Z. F., Kumar, S., & Fayaz, H. (2015). In vitro meat production: Challenges and benefits over conventional meat production. Journal of Integrative Agriculture, 14(2), 241–248. doi: 10.1016/s2095-3119(14)60887-x;

The motivations that are inhibiting people from changing are different between men and women and between different age segment and also between different income categories but the interesting thing that has been observed is the phenomenon that, the more people were informed of the benefits for their health and had nutritional knowledge in terms of scientific information, the more they were likely to show a positive attitude toward the a plant-based lifestyle. Moreover, it has been shown that it is a virtuous circle since adhering to a plant-based diet showed an increase in the interest in nutritional knowledge.[46] It is therefore clear the role that the right flow of information has on the decisional process of the consumer especially when it comes to food choice.

Also, being food an item that is highly connected with feelings and emotions retailers at their selling point should focus on, a part offering an adequate level of quality and variety, aspects of the consumer experience in order to face a desirable increase in sales and be an active part of this change. Food preferences and habits are often connected with situational elements, for example there are foods that since childhood had been used as rewards, or foods that are typical of dining out occasion or celebrations and have therefore a direct connection with the emotion evoked. It has been demonstrated that triggering cues evoking ideas of "health", "sustainable lifestyle", "animal friendly" at the point of sale can have a positive impact on consumer willingness to buy.

Similarly, as at the beginning dairy alternatives and plant-based meat substitutes didn't had space in consumers shopping cart meanwhile today in Europe and in the U.S.A. is part of the usual eating of a rising number of people, meat that comes from a lab will have the opportunity to conquer consumers' trust. Maybe it will happen the same as with cow's milk, that in the last year has registered a decrease in sales of almost 3% compared to the increase of oat milk.[47] Every product on the market has an evolution and substitutions happens as consumer preferences change and evolve and retailers have a focal role in the guidance of this change.

1.5 Organic and "natural" food request in contrast with the clean meat movement

Today, the larger portion of the industrial food production consists of products that have undergone several manufacturing processes that usually take them far away from their original form.

The market, and in particular the U.S. market, is saturated with enormous amounts of all kind of pre-packaged, energy-dense food, including ready-to-eat meals, any kind of cookies or kid's snack, processed meat, cheeses with hundreds of flavours added with several aromas, sugary drinks and colourful yoghurts and whatever is appealing to the eyes and addictive to the taste and therefore to consumers' brain. In fact, it is well-known that food intake is highly connected with emotions and perceptions and most of the times is not a rational choice.

[46] Pribis, P., Pencak, R. C., & Grajales, T. (2010). Beliefs and Attitudes toward Vegetarian Lifestyle across Generations. Nutrients, 2(5), 523–531. doi: 10.3390/nu2050523

[47] Houck B. (Mar 26, 2019), "America's Obsession With Oat Milk Is Hurting the Dairy Industry". Eater. https://www.eater.com/2019/3/26/18282831/milk-sales-fall-2018-plant-based-alternatives

All those substances as additives and preservatives have been largely used and are still used in the food industry for many years now and the food industry marketing has developed on it a high profitability factor for companies.

As Wallach (2019) explains, at the beginning of the 20th century, it was seen as a great revolution, a way how make food more resistant to the passage of time thanks to techniques such as canning and freezing food and making the promise to save time to many enthusiastic housewives. After the Second World War convenient food was necessary and farmers started using chemical fertilization to increase crop yields which on the other side, made the food less nutritious and the government subsidies for in particular corn production has been an incentive for the food industry to use unhealthy ingredients such as hydrogenated oils and modified corn starches.

Then, during the 50's thanks to the economic growth and prosperity the industry of processed food had an incredible rise and the marketing proposed at that time, directed to women, claimed that a part from saving their time it was both a high quality and a healthy option.[48]

Moreover, it started to be possible to constantly offer new products to consumers. This made the consumer used to the constant availability of new flavours and several variants of the same product to never face the "danger" of getting bored of the same taste. No one was concerned about the processes that those nicely packaged items have undergone and especially in America, where food culture is not something with very deep roots back in time, the spread of all those products was massive.

It shouldn't be surprising that for the generation that has been raised during this alimentary "boom", their attention towards health in terms of what they were eating was not their top of mind issue and certainly when it came to what to grab to eat once back home from the office or as a snack while sitting at their desks, health was not such an important factor for the choice at hand or even if it was there was less knowledge about the connection between food and health. In fact it is true that back to the rise of those artificial flavours' empires, there were little or no studies, or at least they weren't made available to a vast audience, about the harms that those substances may cause in kids development or how they could be linked to several kinds of cancer or other diseases and how the wastes produced during their manufacturing were polluting the planet.

With the advent of fast-food giants, the demand for extra flavorous, greasy and savoury food not only raised but has the chance to be satisfied in an even simpler and quicker way. All the processed meat as hamburgers, sausages, sizzling bacon and many others goods were heavily appreciated by the mass public and specifically, those products constitute the 50% of the meat consumed.

Decades later, the results of such habits have given their results. The obesity rate, and all the diseases such as hearth issues and diabetes linked to it, is raising at a concerning speed all over the world and neither young people are immune to it. Obesity and correlated diseases are, in terms of national sanitary costs, one of the first causes of expenditure in America and the obesity rate is expected to grow to 50% of the population,

[48] Wallach, Jennifer Jensen. How America Eats: A Social History of U.S. Food and Culture. Littlefield Publishers, 2013.

therefore a proper information of the link between food and health is crucial also under an economic point of view. The medical care costs of obesity in the United States are higher and higher every year.

In 2008 the expenditure for obesity related illness have reached 147 billion dollars.[49]In the UK, the national health system spent £6.1 billion on overweight and obesity-related disease between 2014 and 2015.[50]

For example, it was detected by the IARC, the international agency for research on cancer, that processed meat is carcinogenic and the consumption of a 50gr. Portion of this kind of meat a day is linked to a 18% increase chance of cancer. This is not due to the animal from which the meat comes, it is due to the processes this meat undergoes before becoming available to the end customer. Moreover, in developing countries higher incomes are linked to higher fat diets especially in the poor and less educated that have no nutritional education. Another dangerous driver in the developing countries is the urbanization effect that attracted large supermarkets and multinational corporation that were able to propose take-away meals in countries as China or India creating processed versions of their traditional meals that are abundant and cheap but also full of fats, salt and sugar (those meals that were originally much more healthy, low fat and plant-based). Globalization has brought to a nutritional transition all over the world and it is not always a positive consequence.

So, adding to this the information regarding the environmental harm caused by the feed and the growth of the livestock, there are clear evidences that this kind of eating habits are not sustainable anymore and fortunately, there is an increasing number of people getting mindful about it. In fact, there is a raising number of consumers especially in the higher-income classes paying more attention to what they put in their grocery carts.

It started with the "fitness lovers", the ones that wanted to be in shape and followed specific diets, whereas it was low-fat or low-carb or some other kind of dietary restriction or preference. They were motivated to read the labels.

Many surveys have demonstrated that the majority of people usually are not aware of the ingredients that are in products they use daily in their kitchens. They only know that they like it, it satisfies their hunger and their taste preferences and so, they eat it.

This happens also because often labels are too complicated to understand for the ordinary consumer and when there are too many or too little information on a package, they might be either overwhelmed or mislead by it.[51]

Especially less educated consumers usually do not use food labels as food choice driver since often they have no idea what should be the right content of nutrients across different foods bringing the tendency to make less healthy food choices.

[49] Finkelstein, E. A., Fiebelkorn, I. C., & Wang, G. (2003). National Medical Spending Attributable To Overweight And Obesity: How Much, And Whos Paying? Health Affairs, 22(Suppl1). doi: 10.1377/hlthaff.w3.219

[50] "Health matters: obesity and the food environment". (March 31, 2017). Public Health England. https://www.gov.uk/government/publications/health-matters-obesity-and-the-food-environment/health-matters-obesity-and-the-food-environment--2

[51] Wansink, B. (2003). How Do Front and Back Package Labels Influence Beliefs About Health Claims? Journal of Consumer Affairs, 37(2), 305–316. doi: 10.1111/j.1745-6606.2003.tb00455.x

Using simple graphic indicators such as organic standardize logos or easy nutritional labels as the nutri-score or traffic light label has been demonstrated to be, can be useful to overcome consumer uncertainty about shat is buying and making them more informed in an effortless way.[52]

Being motivated by the "external" outcome of the food a person consumes, is the more superficial but also the easiest way to make a step in the right direction, since is the first tangible aspect where the impact of an individuals' food choices can usually be seen. In fact, health as a motivation factor, has been recorded to be not so powerful: in a study on the determinants of healthy eating, 40% of Americans and 57% of Europeans affirmed that almost never they would sacrifice taste for improve the healthiness of their current diet.[53] This has enhanced the importance, when it comes to meat substitutes, of taste as the key prerequisite on which invest efforts in order to obtain the desired consumers' acceptance of the product. Meeting consumers expectation on taste and texture is the ultimate and most desirable goal.

However, it is often an issue of lack of information since in recent years it was demonstrated that a higher nutritional knowledge leads to better food choices.

The next step in the process of appreciation of organic and natural food, was the awareness of issues such as the pollution generated from food product transportation all around the world. Transportation (not only of food but in general of manufactured products) is one of the largest contributors toward global warming. Many campaigns have been supported to promote the buying of local products from local producers and they have generated some effect even if it still not significant. The "zero km food" brand firstly appeared in Italy few years ago to address food that hasn't gone through the global trade chain.

Inherently to this, there has been a rising effort in marketing for the origin of the product as a core element of consumer choice. Not only due to distance motivations but many times due to cultural factors, since a product that has been historically produced in a country will probably be better if coming from that country, but also because of quality standards.[54] Different countries have different quality standards for what concerns the production process and the raw material used, the pollution generated and the life quality of the animals that obviously influence the quality of the end product. Location of production plays an important role when it comes to the trust of the consumer and establishing a relationship of trust with the consumer is the most profitable investment a producer, retailer or a company in general, can make. For example, usually the country of origin of a food product has an impact of the willingness to pay of a consumer.

When it comes to organic products even if there have been many studies that have confirmed that there is not a clear connection between the greater healthiness of a product and its feature of being organic, consumer that

[52] Pettigrew, S., Pescud, M., & Donovan, R. J. (2011). Traffic light food labelling in schools and beyond. Health Education Journal, 71(6), 746–753. doi: 10.1177/0017896911424659

[53] Brug, J. (2008). Determinants of healthy eating: motivation, abilities and environmental opportunities. Family Practice, 25(Supplement 1), i50–i55. doi: 10.1093/fampra/cmn063

[54] Lazzarini, Gianna A., et al. "Our Own Country Is Best: Factors Influencing Consumers' Sustainability Perceptions of Plant-Based Foods." Food Quality and Preference, vol. 60, 2017, pp. 165–177., doi:10.1016/j.foodqual.2017.04.008.

buy those products are motivated by their believe that, first of all, it is healthier for them and secondarily, even if in a much smaller percentage, that it is better for the environment.

If there are no many confirmations about the health factor link, it is sure that it has an impact for the environment and for the animal welfare and therefore, indirectly for human health. An organic production, exploits less land and organic feed that have not been treated with any harmful chemicals and first of all is able to breed a lower number of animals since there are space standards to guarantee the welfare of the animal. But even if there was the intention to satisfy the whole food supply with organic food, with the raise of the population it wouldn't be possible due to the increased land used low crop yields of organic farms and a shortage of organically acceptable fertilizers. [55]

However, even if all the producers around the world turned organic, the damage to the environment would still be too powerful and so the need for a valid alternative is the only way to go.

The claim raised by many marketers and business experts against the clean meat feasibility under a profit point of view, is the uncertainty if in the current market situation there would be the desired acceptance and demand for the product. They claim that people are not ready to accept such a "unnatural" product after the time it took them, at least to some of them, to switch their preferences toward organic products which in contrast is the portray of "natural". As it will be explained in the second chapter, the perceive unnaturalness of clean meat is one crucial point on which to work to reach consumer acceptance.

After a long process, the majority of people is still struggling to really get and appreciate the benefits of organic food, since the higher economic cost of buying it is not directly rewarded with tangible cues. Meanwhile for those that are actually preferring the organic option, thanks to higher income or higher knowledge about nutrition and environmental harm, and want to follow a minimally processed diet, the lab-grown meat can be perceived as unmatching their goals or even as genetically modified.

In this regard, when it comes to the comparison with genetically modified food, Mark Post address to the issue saying that clean meat is no an GM food since "Genetic modification is unnecessary for the process. The cells are doing what they would normally do inside the animal, so they do not need to be re-programmed in any way."[56]

Therefore, in a consumer-oriented perspective, the efforts of marketing and media on the communication of the benefits that this kind of new and innovative product offer, will be crucial in making the product enter in the consideration set of the audience both for people that prefer organic and natural products as well for those that want to continue consuming meat since is part of their diet and have no intention to abandon it.

The aim is to achieve a situation where the meat coming from a slaughtered animal is the most expensive and rarely asked option, meanwhile a lab-grown or plant-based quarter pound or chicken nugget is the most common and the most demanded. There will necessarily be a period of transition. At the beginning of the

[55] Badgley, Catherine, et al. "Organic Agriculture and the Global Food Supply." Renewable Agriculture and Food Systems, vol. 22, no. 2, 2007, pp. 86–108., doi:10.1017/s1742170507001640

[56] "How it's made". Mosa Meat. https://www.mosameat.com/technology

process, in order to put people at ease with the new concept and start reducing the feeling of refusal toward lab-grown meat, it will be easier, as it has already been done by companies such as the Modern Meadow[57], to start with lab-grown leather for clothing or furniture items, as an entry level product. People are less concerned of what their shoes or wallets are made of than of what they eat. Then, when it will come to the selling point, firstly, it has been suggested that there should be alternative meat products that are a combination of different productive processes. There have been proposed several suggestions to how make the entrance on the market. Some have proposed to start with a combination that includes both lab-grown meat and conventional meat, preferably with a higher percentage of the latter. Others, have proposed to make an even greener solution, opting for a product that is a blend of plant-based meat such as the one produced by Beyond Meat that is already commonly sold in America and has its established market niche, and the newer "Clean Meat", in order to make people at ease with the new product, cut the costs down and slowly by slowly, making it part of everyone's ordinary diet.

[57] About us. "We design and produce materials for performance and impact". Modern Meadow. http://www.modernmeadow.com/about-us/

CHAPTER 2

Nudge: how choice architecture influences consumers' action in the food choice and how to facilitate the acceptance of cultured-meat as a preferable, sustainable option

2.1 The nudge approach: why and how it works

Going back to the 18th century, the age of Enlightenment has been the movement that apparently has released the human being from the weight and the constraints of superstitions and ignorance. The idea that philosophers, politicians and academics were embracing was that thanks to the power of the rational thought, that brings light over the human existence, the human kind was finally the lord of its faith and this empowerment has dominated the social, political and economic scene till more recent periods.[58]

The majority of neo-classical economic theories are based on the development of another figure, the homo economicus, or econ, that doesn't seem far from the rationally thinking man of the Enlightenment. Despite this would be a preferable and beneficial situation, the idea that people make perfectly reasoned and rational choices, that maximize their utility and that considers all the alternatives available and collect all the accessible information, is far from reality. There is no human being with an unlimited computational ability or infallible information processing mind.

Today researchers have understood that to make proper economic analysis and develop effective economic models, the homo economicus need to make room to homo sapiens. [59]

The truth is that the human being is not rational and the majority of the time makes emotional choices that unfortunately, often result in poor choices.[60] This is also the reason why people often do errors that afterwards may seems perfectly avoidable, if just they have acted rationally. For example, if people were always doing perfectly reasoned and rational choices, the obesity rate wouldn't be growing at the current pace, since the existence of the Econ would assume that everyone was making the best choice to follow a healthy and balanced diet. Even if people are aware of the consequences of their actions, due to the fact that the long-term effect of a healthy life and a fitter body is usually won by the short-term effect of a savoury taste and that there is little feedback for their actions, they end-up choosing less wisely and surely less rationally. This happens because human beings are susceptible of cognitive biases. A cognitive bias is the systematic deviation from a rational

[58] Sally, R. (1999). David Hume, Adam Smith, and the Scottish Enlightenment. Society, 36(2), 41–44. doi: 10.1007/s12115-999-1025-5

[59] Thaler, Richard H. "From Homo Economicus to Homo Sapiens." Journal of Economic Perspectives, vol. 14, no. 1, 2000, pp. 133–141., doi: 10.1257/jep.14.1.133.

[60] Martino, B. D., Dolan, R. J., Seymour, B., & Kumaran, D. (2006). Frames, Biases, and Rational Decision-Making in the Human Brain. Science, 313(5787), 684–687. doi: 10.1126/science.1128356

decision. [61] People experience several kinds of bias, for example, confirmation bias that results from the focus, when collecting information, on only the kind of information that will reinforce one's convictions, or furthermore, the anchoring and adjustment bias, that arise when people tend to rely on the first piece of information they received to make further assumptions. In some occasions those short-cuts can be beneficial and make people decide faster but in other cases it brings to inefficient choices. [62] It shouldn't be a surprise that people often, when choosing what product to buy, use those kinds of automatic responses and shortcuts as help and sometimes they have the function of protection, since they respond to the automatic way of processing the external world, also defined by the Nobel Price Daniel Kahneman, "System 1".[63]

People do not have the resources needed to make a perfectly rational choice and, in many fields, have a lack of expertise that influence their approach. This makes them "novices" in a market where on the other side there are companies that have all the instruments and knowledge of what their offer is, and for this reason, as will be discuss further, trust in another important element when it comes to a new product.

These kinds of mechanisms arise also because individuals are highly influenced by situational factors, emotions and have behavioural schemes that make them use those short-cuts, especially when it concerns situations where they need to overcome a high level of uncertainty. This uncertainty can be due to novelty or simply due to the existence of cognitive limitations that don't allow customers to make perfectly rational choices. The rational choice that takes into account these cognitive limitations, that are unavoidably part of the decision-making process is also referred to as the human "bounded rationality". Bounded rationality was firstly introduced by Herbert Simon. He explained that in order to understand people choices and their errors, it is not possible to consider the theory of expected utility, which is the foundation of the neo-classical economic theories, as something perfectly appliable in the real world.[64]

The theory of expected utility maximization assumes that: first of all, people make choice among a given set of alternatives, meanwhile the truth is that it is a process of acquiring information and most of the times the set of information is not complete; second, people are aware of the probability of each outcome related to each alternative they choose, meanwhile it is more a process of uncertain estimation of the outcome; lastly, people with their choice maximize the expected value of a given utility function meanwhile what people look for and what they can obtain is rarely optimization and commonly a satisfactory level of the desired outcome.[65]

Therefore, the consciousness of these limitations is the starting point for understanding what to do in order to make people act in a certain way and make them opt for better choices. People have two system of thinking:

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[62] Blanco F. (2017) Cognitive Bias. In: Vonk J., Shackelford T. (eds) Encyclopedia of Animal Cognition and Behavior. Springer, Cham. doi 10.1007/978-3-319-47829-6_1244-1

[63] D. Kahneman, Thinking, Fast and Slow, Penguin Books, 2012

[64] Simon H.A. (1990) Bounded Rationality. In: Eatwell J., Milgate M., Newman P. (eds) Utility and Probability. The New Palgrave. Palgrave Macmillan, London

[65] Sent, E.-M. "Sargent versus Simon: Bounded Rationality Unbound." Cambridge Journal of Economics, vol. 21, no. 3, Jan. 1997, pp. 323–338., https://doi.org/10.1093/oxfordjournals.cje.a013673

system 1 that is the fast automatic and intuitive, and system 2 that is the slow, deliberate and conscious.[66] The reason why nudge seems to give better results in terms of behavioural change is because unlike the usual policy tools are addressed to system 2 that require effortful processing, nudging tries to correct those biases that are proper of our intuitive thinking.

Thanks to the many research efforts that has been made in behavioural science and cognitive psychology for the comprehension of human choices, great progresses have been obtained in the range of tools that are now available to governments, institutions and companies for the design and implementation of procedures and marketing actions, focused on achieving a certain outcome in terms of individuals' choice.

One of those tools is "nudge" that is defined by the Nobel Prices Richard Thaler as follows: "A nudge is any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any option or significantly changing their economic incentives. To count as mere nudge, the intervention must be easy and cheap to avoid." [67] It means that there are no prescriptions or economic incentives and no options are banned with a formal law, people are free to choose whatever they want but they are driven toward a better decisional process.

Those who argue against the libertarian paternalism[68] that the nudge application implies, claim that everyone is perfectly capable of knowing and choosing what is in their best interest and that people should not be manipulated to do something else. The fact is, that even without a nudge application, the choice presented to the consumer is framed in some way and it will however influence its decision. Therefore, why not to design and frame the option set in a way that can increase the possibilities of making a good choice, rather than just leaving it up to chance.

It could be claimed, that the unsustainable way of living achieved today and all the consequences arising from it, are the result of the creation of influences that have nudged society toward issues such as obesity, sedentariness, pollution and resource scarcity. Those kinds of nudges can be found in several unhealthy habits the population today manifests: for example, the progressive reduction of green areas, where previously kids were allowed to play and adults to exercise, to increase urban constructions; or the increase and diffusion of entertainment such as video games and social networks that promote steadiness and isolation; or even the general increase of what is considered the normal portion size or the lack of promotion of cycling lanes in cities in order to make cycling safe and easily accessible.

Taken separately those may not seem significant issues but if summed up, they have a huge impact on our habits and therefore on the future condition of our health and the environment.

It is necessary to consider how strongly people are influenced by situational factors, since it is one of the main reasons why nudge is so efficient as a behavioural tool. More specifically, human actions are often motivated

[66] D. Kahneman, Thinking, Fast and Slow, Penguin Books, 2012

[67] Thaler, Richard H., and Cass R. Sunstein. Nudge Improving Decisions about Health, Wealth and Happiness. Penguin, 2009.

[68] Hausman, Daniel M., and Brynn Welch. "Debate: To Nudge or Not to Nudge*." Journal of Political Philosophy, vol. 18, no. 1, 2010, pp. 123–136., doi:10.1111/j.1467-9760.2009.00351.x

by the way in which the problem at hand is framed. As an example, one of the consequences of the context influence on consumers' choice, is the one that explains the so called "compromise effect". What happens is that when a consumer is in front of a choice between different items, the one in the middle will be the most frequently chosen. To this regard, it has been recorded that in six different countries for several different coffee shops the most sold one, more than 70%, was the middle size even if the amount of coffee in each middle cup across the different coffee shops was different. People feel more reassured by choosing what is the middle of their choice set because it is not extreme on any dimension, it seems like neither too much and nor too little, but just the right amount of coffee and the right price to pay for. This happens especially in choices that have low involvement and when it is difficult to evaluate the options. [69] Therefore, knowing that people will go for the option that is in the middle, why not to put a more appropriate amount of coffee, relatively to health indications, in that option.

Another important consideration, that emerged from behavioural studies, is that people usually are not willing to change from their actual situation unless they are pushed to. This is the status quo heuristic, or more simply inertia, that manifests in the tendency to keep going in the same direction or continuing to choose the same alternative even if a change in their circumstances would provide better options.[70] Therefore, since it is not easy to make people change from a used habit, as an unhealthy diet or the tendency to overeat can be, there is the necessity of an external force to act. This external force can be making the healthier option more easily available or more convenient or even creating a sort of rewarding feeling for the good choice made.

There are many examples in the researches about the influence on food choices that confirm how choice architecture can be a powerful tool to make people make healthier and more sustainable choices.[71]

It has been proven that designing user-friendly environments is, in every sector, a key factor to reach successful vending strategies and this applies even more in the food industry given the link between food and emotions and given that psychological factors are among the strongest determinants of what kind of food individuals eat.[72]

Isn't it just right that since for so many years people were nudged by food companies toward unhealthy choices, to have a big shift toward a healthier direction? There are many evidences suggesting that international food and beverage companies sell products that are created with the aim to create addictions based on the maximizing appeal to human innate taste preferences. This contributes to the development of bad habits for fatty, sugary and salty foods enhancing people's appetite and ending up with overeating causing in the long

[69] SOMAN, DILIP. LAST MILE: Creating Social and Economic Value from Behavioral Insights. GUIDANCE CENTRE UNIV OF T, 2017.
[70] Samuelson, W., Zeckhauser, R. Status quo bias in decision making. Journal of Risk and Uncertainty 1, 7–59 (1988). https://doi.org/10.1007/BF00055564
[71] Guthrie, J., Mancino, L., & Lin, C.-T. J. (2015). Nudging Consumers toward Better Food Choices: Policy Approaches to Changing Food Consumption Behaviors. Psychology & Marketing, 32(5), 501–511. doi: 10.1002/mar.20795; Kraak, V. I., Englund, T., Misyak, S., & Serrano, E. L. (2017). A novel marketing mix and choice architecture framework to nudge restaurant customers toward healthy food environments to reduce obesity in the United States. Obesity Reviews, 18(8), 852–868. doi: 10.1111/obr.12553
[72] Canetti, Laura, et al. "Food and Emotion." Behavioural Processes, vol. 60, no. 2, 2002, pp. 157–164., doi 10.1016/S0376-6357(02)00082-7

run several illnesses. There is a conscious and deliberate action to trigger people's senses to develop bad habits altering their perceptions of food and their sense of satiety and satisfaction.[73]

The fields were nudging can achieve its major potential is in those were habits, subconscious processing and situational factors, highly influence the choice process. Therefore, it is assumable that with regard to meat consumption, choice architecture can have a significant role, helping in the achievement of personal goals as a sustainable, healthy diet can be.

Marketers have for many years thought that only providing people with more information will make costumer go for better choices but behavioural science has showed that what really makes them do a better choice is making the choice easier to choose.

2.1.1 The importance of institutions

Today policies aimed at reducing consumption in general, hardly exist and policies regarding producing with fewer local impacts are usually of secondary importance to economic and trade policies.[74]

Not only marketers but governmental institutions have a great power when it comes to sustainability.

The well-being of the environment, of animals and of citizens does not depend only, and fortunately, on the end-user single behaviour, but on the choices of the whole social system that in the end determines the choices that will be made available to this end consumer. The power inherent the authoritative position of institutions and public policies are crucial in order achieve the desired behaviour.

When it comes to the role institutions can have, it is explanatory what Dilip Soleman, the author of "The Last Mile", writes about behavioural change. He goes through the different figures, the lawyer, the economist, the marketer and the behavioural scientist, that in some way influence the behaviour of each society and each individual, and what kind of different approaches are used by those different figures to make people switch from one option to another, form one behaviour to another. In his example, he says that the lawyer will ban the option he is not willing to be the picked-up, the economist says banning is not necessary if you put an incentive that can be negative or positive as some kind of economic tax or economic benefit, the marketer will go with advertising that provides as much information as possible, and in the end, the behavioural scientist will opt for the nudge approach. [75]

Going through those different methods, what the public institution can do is to opt for an appropriate use of a combination of those tools, preferably creating the right balance of proper information release, economic

[73] Gearhardt, A. N., Davis, C., Kuschner, R., & Brownell, K. D. (2011). The Addiction Potential of Hyperpalatable Foods. Current Drug Abuse Reviewse, 4(3), 140–145. doi: 10.2174/1874473711104030140

[74] Westhoek, H. J., Rood, G. A., Berg, M., Janse, J. H., Nijdam, D. S., Reudink, M. A., & Stehfest, E. E. (2011). The Protein Puzzle: The Consumption and Production of Meat, Dairy and Fish in the European Union. European Journal of Nutrition & Food Safety, 1(3), 123-144. http://www.journalejnfs.com/index.php/EJNFS/article/view/30006

[75] SOMAN, D. LAST MILE: Creating Social and Economic Value from Behavioural Insights. GUIDANCE CENTRE UNIV OF T, 2017.

incentive and nudge, considering each time the costs, the feasibility, the importance of preservation of the right to freedom of choice and the long-term effect.

In recent years, the Organisation for Economic Co-operation and Development (OECD) has made several researches that confirmed the power of using elements of behavioural science in the aim of practicing a sustainable public administration with important beneficial effects in different areas included some that are the focus interested of this thesis such as the sustainability of environment and healthy habits.[76]

It could be therefore assumed that using a combination of nudging techniques and economic incentives, can be useful to induce farmers for setting more sustainable practices in the raise of animals and in the culturing of yields, making them willing to take advantage of technological innovation that increase sustainability.

Opening-up to new businesses that use technology as a beneficial tool and facilitating the encounter of farmers, scientists and distribution companies to achieve new horizons in the food area, that can contemporarily satisfies the consumers' demand and the need of preservation of our planet, should be a top of mind matter for institutions all over the world.

In fact, just like the causes of climate change and the difficulties in the use of renewable energy can be traced back to several barriers at three different levels that are the levels of our society functioning, institutional (macro), organizational (meso) and individual (micro), the barriers towards a sustainable nutrition need to be broken down at each of those three levels with customized but interconnected solutions.[77]

There is the need to make become sustainable nutrition an appealing choice. Producers need to be fostered with economical and behavioural tools since it is clear that whatever change that involves a cost/benefit consideration, and a risk in terms of profitability, is impossible to obtain without some kind of incentives that compensate the risk of the investment in new, raising technologies.

Especially in renewable and clean tech sectors incentives are needed to attract capitals and regulatory nudging is necessary to make it feasible and to influence effectively the mass behaviour obtaining a radical change.

Therefore, in the "Clean Meat" industry similar strategies can be used as tax credits, that are used to reduce the income taxes of owners of renewable energy projects or guarantee returns for generators of renewable energy.[78] For what it concern the end-consumer, having rapid feedbacks of the benefits of its choice can have a positive effect: for example in an experiment on nudging toward recycling paper, households that had a weekly feedback on the amount of recyclable paper, produced around 25% more recycled paper than the one

[76] Bourgon, J. (2007). Responsive, responsible and respected government. International Review of Administrative Sciences, 73(1), 7–26. doi: 10.1177/0020852307075686; Sanders, M., Snijders, V., & Hallsworth, M. (2018). Behavioural science and policy: where are we now and where are we going? Behavioural Public Policy, 2(2), 144–167. doi: 10.1017/bpp.2018.17; Lehner, M., Mont, O., & Heiskanen, E. (2016). Nudging – A promising tool for sustainable consumption behaviour? Journal of Cleaner Production, 134, 166–177. doi: 10.1016/j.jclepro.2015.11.086

[77] Bowman, Megan, Nudging Effective Climate Policy Design (December 16, 2011). International Journal of Global Energy Issues, Vol. 35, Nos. 2,3 & 4, pp. 242-254, 2011 . https://ssrn.com/abstract=1986456

[78] Polzin, F., Egli, F., Steffen, B., & Schmidt, T. S. (2019). How do policies mobilize private finance for renewable energy? A systematic review with an investor perspective. Applied Energy, 236, 1249–1268. doi: 10.1016/j.apenergy.2018.11.098

without feedback.[79] Considering the proven effect of rapid feedback in many areas and of short-term tangible effects, when commercialization of lab-grown products will become more common, creating for example a system for giving a feedback to consumers about the amount of water saved or the animals that haven't been slaughtered thanks to their conscious nutrition choices for animal-free meat, can be a proper way on how to nudge people toward sustainable choices.

2.2 Choice Architecture

Choice can be hard. Often people are not really aware of they want and given the high number of alternatives available on the market they end up experiencing a choice overload that sometimes brings to not to choose for the fear of choosing the wrong option. In fact, if it is true that an increase in options increases the chances of finding a matching offer for each consumer preferences, it is also true that the more options are available the more cognitive effort is expected from the consumer, that, as noted above has only limited cognitive abilities.[80]
Bounded rationality assumes people make errors. The fact that many of those errors are systematic and predictable is the foundation for "choice architects" work, in order to reach the desired outcome in terms of human behaviour.
Every single human in the society has, to some extent, the power to be the choice architect of someone else's choice and especially public and private institutions, given their influence, should use this power to improve society's well-being.
Studies had revealed that as the choice becomes more complicated or presents many different alternatives people are more likely to use simplifying strategies.[81] That is also because the human being is fundamentally lazy and if on one hand, laziness is part of the survival instinct, since our nature is to conserve as much energy as possible to be ready for hard times, on the other hand, this laziness can bring to poor and hurried choices. Because of this "conservative" instinct and other biases such as the loss aversion bias, status quo bias and many other systematic errors in human rationality, the importance of a well-structured choice has a great impact on the reached outcome.
It is also important to consider the decision-maker that is being addressed, since a nudge can have different effects depending on the characteristics of the receivers and therefore having a clear idea of the target consumer is fundamental to design an adequate path.
When it comes to the choice of food shopping, considering the numerous alternatives for each product available, a well-designed framing is crucial. Moreover, it has been estimated that a person makes

[79] De Leon, I. G., & Fuqua, R. W. (1995). The Effects of Public Commitment and Group Feedback on Curbside Recycling. Environment and Behavior, 27(2), 233–250. DOI: 10.1086/651235
[80] Scheibehenne, B., Greifeneder, R., Todd, P. M., Can There Ever Be Too Many Options? A Meta-Analytic Review of Choice Overload, Journal of Consumer Research, Volume 37, Issue 3, October 2010, Pages 409–425, https://doi.org/10.1086/651235
[81] Thaler, R. H., C. R. Sunstein. Nudge Improving Decisions about Health, Wealth and Happiness. Penguin, 2009.

subconsciously and consciously around 200 decisions a day regarding food and therefore it is not surprising the use to rely on short-cuts to cope with so many decisions.[82]

Several experiments were undertaken that have demonstrated how the food positioning in supermarkets influence the healthiness of choices.

For example, since it has been recorded that consumers prefer to go through the supermarket in counterclockwise, the majority of stores are designed to follow this path, and since 40% of the sales are from products located at the ends of the lane or in free-standing displays, putting healthy or sustainable products in those sections can increase their consumption and, as a long-term effect, the overall social and environmental health of a country.[83]

In the same way, given the knowledge that milk is the most frequent reason to go to the supermarkets, this item is usually placed at the half way of the store and not at the beginning. The aim is to make the costumer walk next to many other items that when seen, will probably trigger his mind to buy them, and it is therefore assumable that strategic displaying of sustainable and healthy food can work as well.

It can be supposed that putting animal-free meat in strategic locations, or putting it next to some real meat items, can have a positive effect on the willingness to buy. In fact, it is what is already done in the U.S.A with the Beyond Burger that although being a plant-based burger it is located in the same section as conventional meat, just next to the beef burger.[84] Probably it is also a way in which to encourage the trial of such a product even for non-vegetarian costumers that want to try something new and stimulate their curiosity. Moreover, the proximity to a familiar product can have a positive impact on the product judgement itself. Familiarity is a huge influencer on the attitude of an individual toward an item because costumer usually feel more at ease with something they are already used to, even if it is just visually.[85] The simple fact of having been exposed to a brand or a product makes it more susceptible of entering subconsciously in the consideration set of a consumer. This happens with food since childhood with the exposure of children to certain foods and relative taste: people food preferences tend to be oriented toward foods they have been used to in the past. Liked foods are those that are familiar and considered pleasant, and identifying the factors that can make something familiar and pleasant for a certain target can help in predicting consumption behaviour.

People like familiar things, it makes them feel safe and it makes them more prone to try something new. This is the reason why newly released products by a well-known and established brand, are more likely to be appreciated by costumers than new products released by a new and unknown brand. This is also why it is

[82] Wansink, B., Sobal, J., "Mindless Eating: the 200 daily food decision we overlook" Environment and Behavior, vol. 39, no. 1, 2007, pp. 106–123., doi 10.1177/0013916506295573

[83] Thorndike, A. N.,C. R. Sunstein. "Obesity Prevention in the Supermarket—Choice Architecture and the Supplemental Nutrition Assistance Program." American Journal of Public Health, vol. 107, no. 10, 2017, pp. 1582–1583., doi:10.2105/ajph.2017.303991

[84] Purdy, C., (December 19, 2019) "The top US plant-based meat companies are vying for the same territory". Quartz. https://qz.com/1770994/beyond-meat-and-impossible-foods-lead-the-plant-based-race/

[85] Campbell, M. C., & Keller, K. L. (2003). Brand Familiarity and Advertising Repetition Effects. Journal of Consumer Research, 30(2), 292–304. doi: 10.1086/376800

plausible that the interest and participation of well-known meat companies' brands in the business of "Clean Meat" can be one of the ways to break down consumers reluctance for this product.

In addition, considering the context factor influence, an acknowledgement about the formation of preferences can be applied. It has been confirmed that often a preference is formed at the time the choice task is presented. For choices in which an individual has less prior knowledge and experience on the subject, this preference construction is made at the moment, (opposed to the kind of preferences that rely on well-formed and established personal values) and the context and the structure of task have a strong influence on the evaluation and further action.[86]

Therefore, the context in which consumer will have to make their groceries can be framed, together with marketing efforts, in a way that supports aspects such as familiarity, trust, transparency, easiness, availability and immediacy.

The intent is that organizations and companies apply the "translation – auditing – intervention" framework described by Soman when trying to overcome the barriers that keep people away from their choices.[87] Before going more in detail in the description of this approach, it is necessary to make a consideration about one of the deepest reasons of why a good choice architecture is helpful to individuals. Psychology and behavioural science have highlighted the presence of two distinct, and often controversial, aspects of human will that co-exist in every person. There is the "planner" and the "doer". It is a distinction that has consequences in the self-control area and it has been studied in economic and behavioural science often for people's financial planning.[88] In the case of food, the planner is the one that goes to the grocery with a precise list of what to buy, probably including many healthy veggies and necessary goods, but then there is the doer, and here the action-intention gap arises. The "doer" is the one that when at the store makes the consumer stop in front of the nicely packaged snacks, inviting ice-cream or sugary cereals. It also the one that if hungry, will make you buy definitely more than you need, ending up in wasting food and money (or overeat) and easily give in to temptations. Here it is where the choice architect needs to apply his gentle push by framing the context that supports the action of the "planner".

In order to do so it is necessary to "translate" the academic research into business' insights delivering prescriptive advices, "audit" through the understanding of specific touchpoints that are susceptible for the consumer and identify bottlenecks and possible areas of improvement and in the end, "intervene" taking action to design nudging activities. [89]

[86] Coupey, E., Irwin, J. R., & Payne, J. W. (1998). Product Category Familiarity and Preference Construction. Journal of Consumer Research, 24(4), 459–468. doi: 10.1086/209521

[87] Soman, D., LAST MILE: Creating Social and Economic Value from Behavioural Insights. GUIDANCE CENTRE UNIV OF T, 2017.

[88] Shefrin, H., & Thaler, R. (1977). An Economic Theory of Self-Control. The journal of political economy. , 1981, Vol.89(2), p.392 doi: 10.3386/w0208

[89] SOMAN, D., LAST MILE: Creating Social and Economic Value from Behavioural Insights. GUIDANCE CENTRE UNIV OF T, 2017.

2.3 An overview on consumer decision process and purchase behaviour with respect to innovations

"Consumer behaviour reflects the totality of consumers' decision with respect to the acquisition, consumption, and disposition of goods, services, activities, experiences and ideas by humans over time".[90]

Applying this academic definition of consumer behaviour to food items is useful to separately consider the stages which individuals experience in their decisional process. In this process, in the acquisition stage the involved parts are more than one: there is the offering available considering all the competitors, the influence by which the subject is affected, the marketers trying to sell their product and the institutions that through their policies are influencing the available offer. Consumers try to make sense of all the information available and of all the stimuli they are exposed to and make a decision. It is well-known that using rationality is not always the preferred path by consumers and therefore those many factors influencing the consumer choice end up in decisions, that are a mix of information processing and emotions.

Consumers often use products, and especially food products, for regulating their emotions and therefore to make the acceptance and appreciation of a new product more likeable it is needed that it evokes some kind of positive and relevant emotion.[91]

The process of decision making starts with the problem recognition when an unfulfilled need is perceived.

In the case of food, it can be the perception of hunger, the perception of the need of a reward or a social situation that involves choosing among different options of food available. In this stage starts a search for information that is both external, from labels, visual cues or the particular reference group, and internal, searching in personal memory and knowledge, trying to figure out which decision will satisfy that need at its best. Since food is a low-effort decision, the search for information will be short and rapid and all this process will happen in few seconds and people will engage in established schemas that they had followed their whole life. The difference that can be faced with clean-meat, or with any food product that is innovative and new in such a disruptive way, is that it is very probable not to be a low-effort decision but a high involvement kind of purchase. [92]

Strong innovations follow a high-effort path and even if it is food, it is not perceived as a low-risk decision especially for associated safety issues. When a product is perceived as risky it raises the probability of encountering resistance among consumers and it seems easier and safer to continue using the familiar product. There are two components of risk with which the consumer deals: the anticipation of outcome and the certainty of it and the possible negativity of the outcome and how severe it can be. In a situation of high perceived risk consumers tend to process information more carefully especially when it is difficult to evaluate the product

[90] Jacoby, J. (1976). Consumer Psychology: An Octennium. Annual Review of Psychology, 27(1), 331–358. doi: 10.1146/annurev.ps.27.020176.001555

[91] Garg, N., Wansink, B., & Inman, J. J. (2007). The Influence of Incidental Affect on Consumers' Food Intake. Journal of Marketing, 71(1), 194–206. doi: 10.1509/jmkg.71.1.194

[92] Kuvykaite, R., Dovaliene, A., & Navickiene, L. (2009). Impact of package elements on consumer's purchase decision. Economics and management, (14), 441-447. ISSN: 2029-9338

because of little experience, or when it presents high complexity. Surely the process of producing clean meat is something likely to be perceived as complex and this complexity perception can be transmitted to the end product.[93]

Consumers often resist new technologies, and clean meat due to its process can be classified as a new technology, till the moment when they are persuaded to believe that the positive effect of the new product is greater than the risk of dealing with something new.[94] Also, when people identify themselves with a certain brand or product consumption and it can happen also with food, it can be difficult to switch to a new brand or product.[95] Therefore, including the meat industry in the clean meat business is likely to help the familiarity perception and make consumers feel safer and at ease reducing, perhaps, the perceived risk.

Assuming then how difficult it can be for a new product to enter the consumer consideration set, making a new product well visible with a high exposure, sharing information that are relevant to the consumer, reassuring the consumer about safety and its benefits as well as triggering both the irrational and emotional side of the consumer, can have important effects in the stage of need recognition.

To this regard, a look at the conventional classification of human needs, and perhaps an updated consideration of it given the development of social influences on food choices along with the diffusion of social media, can bring some useful insights.[96]

Taking as reference the Maslow's need pyramid, food is classically labelled as a primary physiological need.[97] The truth is that nowadays, food has become something more than just a physiological need. For many individuals, what they eat and the diet they follow is part of their identity, is a way of communicating themselves to the world. It touches both the personal and the social aspect of someone's life.[98] Therefore, the choice of food can reflect a particular (desired or acquired) status quo, a moral affirmation or a cultural choice. Many consumers' attitudes towards food can only be understood by considering them in the context of self-actualization and self-fulfilment needs. Thus, the offering has to meet the self-concept of the consumer and represent in some way their values. To this regard labelling and packaging assumes an important role since it makes easer for the consumer to select products consistent with their values.[99]

Marketers often use consumer goals and values to target a specific market and develop an effective communication strategy. Consumers today are overwhelmed with promotional material and an overabundance

[93] Kaplan, L. B., Szybillo, G. J., & Jacoby, J. (1974). Components of perceived risk in product purchase: A cross-validation. Journal of Applied Psychology, 59(3), 287–291. DOI: 10.1037/h0036657

[94] Mick, D. G., & Fournier, S. (1998). Paradoxes of Technology: Consumer Cognizance, Emotions, and Coping Strategies. Journal of Consumer Research, 25(2), 123–143. https://doi.org/10.1086/209531

[95] Lam, S. K., Ahearne, M., Hu, Y., & Schillewaert, N. (2010). Resistance to Brand Switching when a Radically New Brand is Introduced: A Social Identity Theory Perspective. Journal of Marketing, 74(6), 128–146. https://doi.org/10.1509%2Fjmkg.74.6.128

[96] Pachucki, M. A., Jacques, P. F., & Christakis, N. A. (2011). Social Network Concordance in Food Choice Among Spouses, Friends, and Siblings. American Journal of Public Health, 101(11), 2170–2177. doi: 10.2105/ajph.2011.300282

[97] Maslow, A.H. (1943). "A theory of human motivation". Psychological Review. 50 (4): 370–96. doi:10.1037/h0054346

[98] Cruwys, T., Bevelander, K. E., & Hermans, R. C. (2015). Social modeling of eating: A review of when and why social influence affects food intake and choice. Appetite, 86, 3–18. DOI: 10.1016/j.appet.2014.08.035

[99] Bruhn, C.M. (2000) Introduction. In Food Labelling. pp. 1–30. Woodhead Publishing Limited, Cambridge

of products, therefore in order to make sure that the consumer is motivated to process the promotional material, making it as much personally relevant as possible helps to create a connection. It is necessary to frame the offer of clean-meat in a coherent way with the desired target consumer and position it in a way that enhances its compatibility. Creating an offering in a way that makes the consumer feel in line with its goals, as a healthier and more conscious lifestyle can be and, in a broader perspective, being aware of the cultural context that can be exerting a strong influence as well. People often use old schemas and have difficulties to be more open-minded. The role of the marketer is to nudge the consumer toward a new point of view, when the "aha" moment arises and the new choice seems the most obvious one.

Even if the ultimate aim is to reach all the meat eaters and non-meat eaters, having a niche from where to start is always necessary. With every innovation, the innovators followed by a larger portion of early adopters, are fundamental and this applies as well for an innovation as the clean meat.

Usually, innovators have been identified to have several demographical, behavioural and psychological characteristics than can be used to identify them as the initial target market for an innovation. Among the common pattern that contradistinguish them, they are usually young, higher income class and better educated, all characteristics predicting a major use of medias and therefore more prone to be informed about new products.[100] This media involvement can be used from companies that want to launch a new product to reach this kind of consumers. Social media has a huge impact especially on younger consumers also because it permits him to transmit and share the information they've reached. Many successful brands are already taking advantage of this new channel through which create awareness and in the long run loyalty and advocacy. We can also assume that given the sensibilization about topics such as animal welfare and environment on social media, using them through the reach of the right influencer can work as an educational campaign especially among the younger that are more reactive to changes and tend to follow the behaviours of their favourite virtual role models. It can be a powerful mean to target young women that have been detected to be more reluctant than man when asked about trying clean-meat. Women were also found to use and check social media sites more than men.[101] As it was at the beginning with organic food and healthy food, women, also because they are still usually the one deciding about the meals organization of the household, will probably be more easily persuaded through social media.

When trying to understand the potential of the entrance of clean meat on the market, something that can be viewed as a reference is the entrance of organic food in the Chinese market.

Organic food has been a Western invention and initially it was not reaching at all the Asian market. [102] Due to the reasons mentioned in the first chapter, it is very desirable that the Chinese population understands the

[100] Dedehayir, O., Ortt, R. J., Riverola, C., & Miralles, F. (2017). Innovators And Early Adopters In The Diffusion Of Innovations: A Literature Review. International Journal of Innovation Management, 21(08), 1740010. doi: 10.1142/s1363919617400102

[101] "Women are driving the social media revolution". ConnectAmericas. https://connectamericas.com/content/women-are-driving-social-media-revolution

[102] Lockeretz, W. (2007). Organic farming: an international history. Oxfordshire: CABI. https://books.google.it/books?hl=en&lr=&id=clJSfx3JnIkC&oi=fnd&pg=PR5&ots=R64id8Umts&sig=TBom5fRQyWh3AK6bckhPCOVt0uY&redir_esc=y#v=onepage&q&f=false

importance of a sustainable diet trying to limit the consequences of the diffusion of a Western heavy-on-meat diet. Apparently, it seems that there is an emerging market for it and even if it has not significant dimension yet, it is at least a starting point.

For the Chinese consumers, organic food was recorded to follow a high effort path because of the perception of being cheated by the seller when buying something labelled as "green".

The starting point from which it is hoped that a larger diffusion will take place, are those few consumers for whom the acquisition of food is a high-effort issue and weight enough environmental and ethical issues. Also, it is true that being exposed to an organic product in China is very difficult since it accounts for only the 0.08% of total consumption. The product factors that had the major importance when adopting organic food has been reported to be price and quality relatively to conventional products, meanwhile the context factor that had an important influence was the exposure to educating campaigns about organic food and its environmental benefits. [103] It can be assumed that in the future, considering clean meat a high effort decision and a high-risk perceived decision, creating educational campaigns in collaboration with public institution can lead to a great impact on the product acceptance. The company needs to educate consumers to understand the product and its advantages.

Another aspect of the consumer behaviour that can have consequences on food choices is considering the action – intention gap in food behaviour. Often the human behaviour is subject to this gap, meaning that the person had a certain intention, as it can be buying healthier food, but then reality jumps in with some unpredictable events like a bad discussion at work or traffic jam that makes him arrive late to the grocery store, and the action ends up to be different from the planned intention, falling in the old automated habits.

When it comes to the buying organic food there has been detected a weak relationship between the intention and the behaviour when the organic product was perceived as more difficult to find making accessibility a relatively stronger behaviour predictor.[104]

As with organic products, part of the process of making the soonest possible clean-meat a reality, is how rapidly and to which extent it will be made accessible on the market and through which distribution channels. Price in another important factor to consider when creating the marketing mix of a product since it strongly influences product perception and willingness to buy. Consumers often make inferences about an offering based on its price and when they use it as a shortcut in decision process, they often overestimate the actual relationship between price and quality.[105] Among younger and more educated consumers, the interest in choosing higher quality and more sustainable food is a rising trend. Usually, younger consumers, as for instance students, are as well the one that have to make purchase decisions on a budget. It has been found that actively highlighting the exposure of retail of local foods to increase the consumer level of product

[103] Yin, S., Wu, L., Du, L. and Chen, M. 2010. Consumers' purchase intention of organic food in China. Journal of the Science of Food and Agriculture, 90: 1361–1367. DOI 10.1002/jsfa.3936

[104] Thøgersen, J. (2009). Consumer decision-making with regard to organic food products. Traditional food production and rural sustainable development: A European challenge, 1, 173-192.

[105] Shapiro, B. P. (1973). Price Reliance: Existence and Sources. Journal of Marketing Research, 10(3), 286. doi: 10.2307/3149696

involvement with marketing campaigns such as "buy local" or holding events, has the power to increase their willingness to pay for local products. The product involvement resulting in a higher willingness to pay can be increased also with the use of emotionally-oriented marketing strategies, as images of the farmers with their products or advertising that shows stages of the producing process, or even the environment in which animals are raised, can connect the consumer in a more personal way. It is also a way in which overcome the perception, that sometimes occurs, of being cheated by the marketer.[106] Many conventional products are already using this strategy in tv advertisement especially in the food industry. Showing the people involved in the production process and their commitment to the product can have a reassuring and appealing effect. It is a way of enhancing trust feelings that are connected with the perception of paying a fair price even if it is higher than other similar goods. However, when it comes to a new complex technology showing the production process is not helping because of its complexity. Focusing on the benefits and on the trust and reputation of the company can make enhance the evaluation of the product and therefore the willingness to pay. In some limited research some participants were willing to pay even a price premium for clean-meat when the communication was done in an appropriate way. [107]

2.4 Nudging toward sustainable behaviour: social influence and efforts to achieve consumer acceptance

"If sustainable behaviour is only encouraged, but is not enabled and mediated, it will be difficult for people to act sustainably." [108] This claim made by the Sustainability Guide, a project that promotes the interaction of designers and customers to develop sustainable way of designing products and services summarizes clearly the need of behavioural science approach in achieving of a more sustainable community.

The majority of people for cultural, educational, behavioural reasons will not actively change their behaviour toward healthier, both environmentally and physically, choices unless there are driven to do so.

Going toward a more sustainable way of living on this planet can be pursued in many ways, each of which contributes in some measure to the purpose. From recycling, to green mobility, to the use of renewable energy, to the tailoring of high fashion clothes with recycled material, to the use of new technologies to generate food without harming and over-exploiting our resources.

For example, for what it concerns the city transport, an action that have benefits both on health and on environment is the promotion of initiatives that make bicycles available through public hire schemes creating an alternation in social norms nudging people to cycle rather than choosing other options. People are influenced by others and the functioning behind this nudge is that the simple fact of seeing more people using

[106] Campbell, J., DiPietro, R. B., & Remar, D. (2014). Local foods in a university setting: Price consciousness, product involvement, price/quality inference and consumer's willingness-to-pay. International Journal of Hospitality Management, 42, 39–49. DOI: 10.1016/j.ijhm.2014.05.014

[107] Verbeke, W., Sans, P., & Loo, E. J. V. (2015). Challenges and prospects for consumer acceptance of cultured meat. Journal of Integrative Agriculture, 14(2), 285–294. doi: 10.1016/s2095-3119(14)60884-4

[108] Selvefors,A., Renström, S., (2018). "Design for Sustainable Behaviour". Sustainability Guide. https://sustainabilityguide.eu/methods/design-sustainable-behaviour/

a bicycle can creates a new social norm and the visual trigger encourage people to want to cycle as well. It is giving people a simple access to an option without forbidding others.[109] Therefore, in this case, the influence of seeing peers behaving in a certain way, plus the easy access to that behaviour creates the combination for a change in the mass behaviour.

An insight of how things can change and how the public opinion can be influenced if triggered in the right way is easily found in the fashion industry. In past years it would seem absurd and very "unglamorous" to see celebrities, actors or top modes with suites and dresses designed with a fabric made with recycled material but today, the association of haute-couture with terms such as sustainable and recycled is not a no-sense anymore. Today there are events such as the "Green Carpet Fashion Award", were worldwide known designers such as Gucci and Chopard, and emerging designers have the opportunity to show their ability to create incredibly luxurious and elegant gowns, suites and accessories with recycled materials.

In the same way as wearing a coat made with the leather of an animal, today may seems absolutely unnecessary and outdated because we don't need to kill animals anymore to cover up, in a not too far future killing animals to eat food should become an outdated absurdity since new technologies permit to produce whatever we desire without the use of an alive being.

The comparison with the fashion industry is not purely accidental. As noted above, people tend to be less concerned with what they clothes are made up rather than the food they eat. Therefore, starting to empower the idea of lab-grown leather used for wallets and shoes and trying to involve established luxury companies to use these technologies to make their creation can put people at ease with the idea. Once that important fashion companies, endorsed by celebrities and other society prominent, start to appreciate the product, its acceptance can rapidly grow, just as it happened with recycled materials. There is the need for many actions that put together, have a big impact on the public opinion. It should be a progressive naturally occurring shift in the society, achieving acceptance through little changes.

People are social beings that are never really free from the judgement of others. They tend to conform their actions to the majority of members of their social group because they want both be as their reference group and be liked by the other members. The need of a feeling of belonging to a group is strongly impacting individuals' choices.[110]

Many researches have shown how the social context in which one is consuming its meal, influence the choice of that meal.[111] For example, women tend to eat more when in presence of other women and less when there are men whereas men, when eating with a woman or other men tend to eat more those foods that are commonly

[109] Cabinet Office Behavioural Insights Team. Applying Behavioural Insight to Health. (2010). UK. http://www.cabinetoffice.gov.uk/sites/default/files/resources/403936_BehaviouralInsight_acc.pdf

[110] Asch, S. (1955). Opinions and Social Pressure. Scientific American, 193(5), 31-35. www.jstor.org/stable/24943779

considered as "masculine foods" as big steaks that are associated with protein and strength than they would do if alone.[112]

Here another important issue comes out: the gender difference in eating prejudices. Man, meat and masculinity is an archetype that have been running in the social opinion for so many years now that it is comprehensible how difficult it is today to overcome it.

Also, if looking at marketing efforts in the food industry, it easy to recall the image of a man eating a big hamburger or a bucket of chicken wings than a woman in the same context and on the other side the image of women is more commonly associated with a fruit salad or something considered healthy.[113] Many men reported that vegetarian people are perceived as less masculine and more sensitive and emotional, and physically weaker, which is not exactly the image that the majority of men have, or want to have, of themselves.[114] Even if scientific evidences have shown that there is no link with masculinity and meat consumption and that some researches has detected that a larger amount of plant-based protein brings to higher level of testosterone and virility power, it is still an association that influence eating patterns across generations. [115]

However, some progresses have been made. When firstly plant-based products that should serve as substitutes of meat for vegetarians in order to add some variety to their diets and assure a good amount of protein intake, came to the market, people with ordinary diets were not interested in buying them. Today, in developed countries, eating plant-based and organic has become almost a status symbol also because of the higher price those products often face.[116] There has been an increase of popularity of the plant-based diet even among male athletes, showing how a plant-based diet can be beneficial for sport performance goals. This had impacted positively the general opinion making them more appealing also for the man public that is the one that traditionally show more reluctance to abandoning their "masculine" meat consumption habits. In addition, in a study made in 2008, male participants when asked about how their diet identifies their masculinity, they were not really able to answer the question but were able to make assumptions about other men that lived alone. They were the one stereotyping their gender. What they described to be the diet of a hypothetical male subject, was the unhealthy diet made of pizzas, fast food and take-aways. So, even if they said to be aware and

[112] Furst, T., Connors, M., Bisogni, C. A., Sobal, J., & Falk, L. W. (1996). Food Choice: A Conceptual Model of the Process. Appetite, 26(3), 247–266. doi: 10.1006/appe.1996.0019; Pliner, P., & Chaiken, S. (1990). Eating, social motives, and self-presentation in women and men. Journal of Experimental Social Psychology, 26(3), 240–254. doi: 10.1016/0022-1031(90)90037-m

[113] Newcombe, M. A., Mccarthy, M. B., Cronin, J. M., & Mccarthy, S. N. (2012). "Eat like a man". A social constructionist analysis of the role of food in men's lives. Appetite, 59(2), 391–398. DOI: 10.1016/j.appet.2012.05.031

[114] Ruby, M. B., & Heine, S. J. (2011). Meat, morals, and masculinity. Appetite, 56(2), 447–450. doi: 10.1016/j.appet.2011.01.018

[115] Allen, N. E., Appleby, P. N., Davey, G. K., & Key, T. J. (2000). Hormones and diet: low insulin-like growth factor-I but normal bioavailable androgens in vegan men. British Journal of Cancer, 83(1), 95–97. doi: 10.1054/bjoc.2000.1152

[116] Reinicke, C. (July 11, 2019). "Beyond Meat costs more than traditional meat, but data show consumers are willing to pay the premium price — for now (BYND)". MARKETSINSIDER. https://markets.businessinsider.com/news/stocks/beyond-meat-sales-are-high-but-so-is-price-2019-7-1028346898

conscious of the importance of a healthy diet and of eating more fruit and vegetables, they still had this idea about other men.[117]

Interestingly, when it comes to lab-grown meat, in a study with US participants it has been detected that men are more likely to give it try and make it part of their diet than women. It has been also found that vegan and vegetarians, even if being the one that perceived more the benefit on the environment and the ethicality of clean meat, they were less likely to try it than meat-eaters.[118] In the same study one of the things participants were more sceptical was the taste of the product. No one wants to sacrifice the taste of a real steak or burger if they can have the original one. The fact is that the taste perception can be linked to the reaction of disgust and fear that has been detected in another study that will be later presented. Therefore, combining the results of those different study is possible to infer that firstly, it is the unnaturalness perception, that brings to concerns about safety that brings to disgust, that brings to doubts about how the product will taste and therefore to the unwillingness to buy it. Delivering and communicating a great taste performance must be a priority.

However, one of the highest concerns of all the consumers in all the different studies conducted was remarkably the "unnaturalness" of the product. Marketing efforts together with nudging tools should focus on breaking this main barrier to reach consumer acceptance.

2.5. Animal welfare and consumers experience of the meat-paradox

The current worldwide dietary pattern that faces a general increase in the consumption of animal products, involves many challenges under an ethical point of view for what it concerns animal welfare.

Even if in some Western countries there is a slight trend toward a meat consumption reduction and there are movements trying to reduce the amount of animal-protein in the diet and the number of vegetarians and vegans is slightly increasing every year, the number of animals raised for food production is still very high. In 2018, only in the U.S.A, 9.58 billion of land animals have been slaughtered for food production.[119]

A first positive step toward a higher consciousness about the importance of animal welfare in the industry of food has been done in 1965, when the UK government instituted a special commission to start an investigation to uncover the situation of intensively farmed animal in the country. The decision was taken after Ruth Harrison, a British woman wrote the book "Animal Machines" describing the intensive poultry and livestock farming.

The report written by Brambell, the professor in charge of the investigation, stated some standards to how animals should be raised.[120] As a result, in 1979 the Farm Animal Welfare Council adopted those guidelines

[117] Sellaeg, K., & Chapman, G. E. (2008). Masculinity and food ideals of men who live alone. Appetite, 51(1), 120–128. DOI 10.1016/j.appet.2008.01.003

[118] Wilks, M., & Phillips, C. J. C. (2017). Attitudes to in vitro meat: A survey of potential consumers in the United States. Plos One, 12(2). doi: 10.1371/journal.pone.0171904

[119] U.S. Land Animal Slaughter (2018): Livestock Slaughter: 2018 Summary (Apr 2019)

[120] Brambell, F.W. (1965). Report of the technical committee to enquire into the welfare of animals kept under intensive livestock husbandry systems.

as the Five Freedoms.[121] In 2009, the European Union enlarged the five freedoms framework and made a new report, the Welfare Quality. In both the Brambell's report and the Welfare Quality report it is highlighted that the farming environment has to enable the natural behaviour of the animal. Also, the World Organisation for Animal Health adopted the Five Freedoms model considering an animal to be in a good state of welfare if it is "healthy, comfortable, well-nourished and able to express innate behaviour and not suffering from pain, fear or distress".[122]

The concentrated animal feeding operations (CAFOs) due to the high number of animals raised in a limited space, does not allow the natural behaviour of the animal. Also, another of the Five freedoms is violated as the freedom from fear and distress. Animals living in small areas, not allowed to move properly and ending their life with a slaughtering processes that see many animals queueing to be slaughtered, making one animal to see the other being killed and knowing what is going to happen, is surely not saving the animal from fear and distress.

At the same time, the number of owned pets has never been so high. In the U.S. 67% of households owned one or more pet in 2019 and pet-ownership rate has increased of 11% from 1988.[123] Also for what it concerns food production, there has been an increasing consciousness among consumers and their interest in the way animals are living in farms.

In the last two decades, positive evidences in many developed countries of an increasing demand for products that are perceived to be more "animal-friendly" such as free-range eggs have arisen. The problem is that often consumers perceive "organic" label on meat or other animal-products as an indication of being free-range. Even if organic products have to respect some higher standards than conventional products under animal welfare point of view, those standards don't exceed much the legal requirements.[124]

Concerns and consciousness about animal welfare issues are rising, but still it seems that there is a sort of disconnection between eating meat and considering it as an animal welfare issue. It has a lot to do with cultural aspects, that often see a shift in time on which animals are considered as food and which are not. For example, for Western individuals it would seem cruel and brutal to eat a dog or a cat but at the same time they will probably have no problems to eat a cow or a pig that are animals as well. Or, till more recent years eating whales and horses were considered acceptable as well, whereas now they whales are considered wildlife and horses pets.[125]

[121] Mcculloch, S. P. (2012). A Critique of FAWC's Five Freedoms as a Framework for the Analysis of Animal Welfare. Journal of Agricultural and Environmental Ethics, 26(5), 959–975. doi: 10.1007/s10806-012-9434-7

[122] World Organization of Animal Health 2008 Introduction to the recommendations for animal welfare, Article 7.1.1. 235-236 in Terrestrial Animal Health Code 2008. World Organization for Animal Health (OIE), Paris.

[123] 2019-2020 APPA National Pet Owners Survey

[124] Harper, G. C., & Makatouni, A. (2002). Consumer perception of organic food production and farm animal welfare. British Food Journal, 104(3/4/5), 287-299. doi:10.1108/00070700210425723

[125] Bastian, B., & Loughnan, S. (2016). Resolving the Meat-Paradox: A Motivational Account of Morally Troublesome Behavior and Its Maintenance. Personality and Social Psychology Review, 21(3), 278–299. doi: 10.1177/1088868316647562

Meanwhile, in China till very recent days, eating dogs was perfectly normal. Thankfully, probably the diffusion of the Covid-19 has influenced the decision, at the beginning of April 2020, Shenzhen has been the first city in China to adopt new regulations with which cat, dogs and some species of reptiles an wild animals have been removed from the list of animals that are legal to slaughter and consume. [126]

However, although the rising consciousness about the importance of animal welfare and the love toward animals, meat-eaters constitutes a majority, and they are the same individuals that loves animals and claim to respect them and would never do something cruel to them. The phenomenon that occurs is the so-called meat paradox.[127] Meat eating includes a conflict between, on one side, the dietary preference, and on the other side, finding animal suffering emotionally disturbing. To overcome this disturbing feeling, people activate almost automatically, a process of dissonance reduction. There have been detected three main mental strategies that are used as justification in meat eating to overcome the perceived immorality of behaviour: harm, identity and responsibility. Harming another being is only problematic for individual's morality when there is the perceived ability of this other being to suffer that is often connected to the capacity to reason. Therefore, since the capacity to reason of many animals is often underrated, it becomes a way how to overcome the dissonance. Also, categorization of animals in food animals and no-food animals is a way in which reduce the perceived ability to feel harm from the side of the animal. Then there is the responsibility strategy. People perceive themselves guilty when they feel responsible for their actions. However, in meat eating people may reduce their responsibility by viewing their behaviour as diffused through collective action in the society. Morally troublesome behaviour in this way can be overcome by considering the behaviour as natural, normal and necessary as the idea that "humans were meant to eat meat". Then it comes the role of identity. The problem to overcome here, is that the immoral behaviour defines the self. People often underreport, even unconsciously, the frequency and the amount of meat they eat and judge others more harshly to present oneself as more virtuous.[128]

Those findings reveal that people, especially in today more conscious society, are experiencing this moral dilemma and clean meat can be their solution. Eating meat can be considered a behaviour induced by social influence, as family, and by the acquisition of a habit, in this case meal time, that usually occur at least three times a day. Therefore, even if for ethical and moral reason they would be willing to consume less meat or stop consuming it totally, they find it difficult to abandon their habit and with clean-meat they could solve the problem. Moreover, for many people it is difficult to think of some new ingredients with which to substitute meat in a meal and therefore giving them an alternative that can play exactly the same role can be helpful and clean-meat can easily assume this role once the price issue is solved.

[126] Guy, J., Jiang, S., Wang, S. (April 2, 2020). "Shenzhen becomes first Chinese city to ban consumption of cats and dogs". CNN. https://edition.cnn.com/2020/04/02/asia/shenzhen-cats-dogs-ban-scli-intl/index.html

[127] Loughnan, S., Haslam, N., & Bastian, B. (2010). The role of meat consumption in the denial of moral status and mind to meat animals. Appetite, 55(1), 156–159. doi: 10.1016/j.appet.2010.05.043

[128] Bastian, B., & Loughnan, S. (2016). Resolving the Meat-Paradox: A Motivational Account of Morally Troublesome Behavior and Its Maintenance. Personality and Social Psychology Review, 21(3), 278–299. doi: 10.1177/1088868316647562

2.6 Current acknowledgement of consumer perception of food items: insights for Clean Meat perception issues and detected strategies to overcome the "unnaturalness" barrier

In developing a new product, consumer insight is fundamental in order to meet consumer acceptance and satisfaction especially when it is related to a mature and established market as the meat industry is.

To understand how the clean meat can be processed in consumers' minds starting from having a look to the current knowledge about the process involved in establishing the consumers' purchase of food products and of products newly introduced on the market can give some useful insights. One important feature is the perceived quality. There are two important aspects to consider in the quality perception of a new food product. It is necessary to understand how the product is going to be perceived before the first purchase, when all the features of the product are unknown and are depending only on the consumers' expectations, that are the result of communication efforts and of the physical appearance of the product. Then, forecast how the product will be perceived after the trial. When the consumer experiences the product, taste and convenience perception will depend directly on its physical experience, meanwhile dimensions such as health perception and concerns about production process issues, will still depend on communication and trust in the information source. The overall judgement of this process will determine whether the consumer will continue buying the product. [129]

The first concept that is important to deliver to the public when it comes to cultured meat is that conventional meat is far from being natural. Once people have understood that the way animals are treated and the meat is processed and that the substances used in the process, have often nothing to do with nature there is a higher chance that they start considering clean meat as food and not as something fake and potentially harmful. Another issue to consider is that many consumers, when asked, claimed that even if they may see the benefit for the environment, they couldn't perceive the direct benefit for their own lives.[130] It is possible that creating cues that make the benefit more concrete in the consumer mind can have positive impact on the approach to the new product.

In fact, one of the barriers presented by consumers when it comes to food processed with new technologies, not necessarily cultured meat, is that it could be potentially harmful and can have unknown health risks. This happens because foods processed with new technologies are often perceived as unnatural, unsafe and unhealthy.[131] On the other side what could increase the interest in new technology food is an increased nutritional and taste benefits and therefore, major importance should be given to those characteristics in the

[129] Grunert, K. G., Verbeke, W., Kügler, J. O., Saeed, F., & Scholderer, J. (2011). Use of consumer insight in the new product development process in the meat sector. Meat Science, 89(3), 251–258. doi: 10.1016/j.meatsci.2011.04.024

[130] Verbeke, W., Marcu, A., Rutsaert, P., Gaspar, R., Seibt, B., Fletcher, D., & Barnett, J. (2015). 'Would you eat cultured meat?': Consumers reactions and attitude formation in Belgium, Portugal and the United Kingdom. Meat Science, 102, 49–58. DOI: 10.1016/j.meatsci.2014.11.013

[131] Cardello, A. V., Schutz, H. G., & Lesher, L. L. (2007). Consumer perceptions of food processed by innovative and emerging technologies: a conjoint analytic study. Innovative Food Science and Emerging Technologies, 8, 73–83. DOI: 10.1016/j.ifset.2006.07.002

marketing effort. [132] However, once the barrier to the trial has been broken down, taste together with quality, have been recorded as the most important factors influencing acceptance and if this has been something on which plant-based meat companies have been able to work on and have positive results, for lab-grown products there is still a biased perception.

There is a common bias that whatever is natural is safer and that the human "contamination" food or food that is labelled as organic tastes better. However, when the only study available on the subject has been done in 1976, it resulted that organically growth vegetables were not rated superior in taste to commercially grown ones.[133] If it is right to buy organic food for its gentler environmental impact, buying it for a better taste is many times a bias.

It is also not surprising that as a result of the extreme level of exploitation of earth resources and the evidences of climate change and pollution consequences, human intervention has started to have a negative connotation. Therefore, this negative perception can be experiences about food that has been in contact with machines or chemicals made by humans.[134] But it is necessary to make distinction between among what kind of human intervention is good and what is harmful. For example, some natural pesticides have been revealed to be more cancerogenic than the artificial ones since to be effective they are used in more massive amounts. In the case of clean meat, the evidence of superiority in safeness for both the environment and for humans is undeniable. In a study conducted in 2012 among participants from Belgium, Portugal and the UK it resulted that the most common reaction to lab-grown meat was fear and disgust, and then concerns about health and safety. [135] Disgust, or as it has been largely defined, the "yuck" factor[136], was the strongest emotion that lead to a major difficulty in giving a chance to considering the product benefits and what has arisen from the analysis of the conversations participants had after watching the video, was that the feeling of disgust was linked to the feeling of transgressing the rules of what should have been a natural product. The disgust was not linked to the content of the food but to the production process of it. Again, it is very likely that if those same consumers were really informed about how several of the foods that they eat on a regular basis are produced, they wouldn't find the clean meat process so disgusting. Those giant strawberries we find today in the supermarkets, or those perfect apples or the progressive increase of milk expire date, all those aspects are not what should be considered "natural".

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[132] Grunert, K. G., Verbeke, W., Kügler, J. O., Saeed, F., & Scholderer, J. (2011). Use of consumer insight in the new product development process in the meat sector. Meat Science, 89(3), 251–258. doi: 10.1016/j.meatsci.2011.04.024

[133] Schutz, H. G., & Lorenz, O. A. (1976). Consumer Preferences For Vegetables Grown Under "commercial" And "organic" Conditions. Journal of Food Science, 41(1), 70–73. doi:10.1111/j.1365-2621.1976.tb01103.x

[134] Rozin, P., Spranca, M., Krieger, Z., Neuhaus, R., Surillo, D., Swerdlin, A., & Wood, K. (2004). Preference for natural: instrumental and ideational/moral motivations, and the contrast between foods and medicines. Appetite, 43(2), 147–154. doi: 10.1016/j.appet.2004.03.005

[135] Verbeke, W., Marcu, A., Rutsaert, P., Gaspar, R., Seibt, B., Fletcher, D., & Barnett, J. (2015). 'Would you eat cultured meat?': Consumers reactions and attitude formation in Belgium, Portugal and the United Kingdom. Meat Science, 102, 49–58. DOI: 10.1016/j.meatsci.2014.11.013

[136] Weele, C. V. D., & Driessen, C. (2013). Emerging Profiles for Cultured Meat; Ethics through and as Design. Animals, 3(3), 647–662. doi: 10.3390/ani3030647

The fact is that in many cases the preference for "natural" is something linked to a moral and idealistic conception rather than the effective and real instrumental side of this characteristic. Even when in front of two chemically identical products, people claim to continue preferring the "natural" one.

In the same study it was detected that people were also raising the issue that the decrease of land used for the livestock would be a factor enhancing the urban sprawl. With the demographic increase urbanization will grow in any case, decreasing the land used to raise the livestock and the land used to produce large amounts of soybean necessary to feed the livestock, it is possible to decrease deforestation and a lot of pollution. Claiming that freeing the land used for livestock is a bad thing, is like claiming that using free land to the implant of wind turbines to obtain green energy is something to avoid.

In addition to this, respondents often claimed that meat consumption is a physiological part of the human diet and that humans had always eaten animals and therefore there is no reason to have the need of a technologically generated meat. Other research has also detected that in some cases there were people that considered eating meat as part of their identity.[137] Now, if it is true that people have always eaten animals it is also true that the amount of meat that we eat today, is not at all comparable to the amount that can be produced adopting a "natural" way of raising the animal, since the production process of meat is very distant from respecting any nature's cycle. One thing is to raise few animals in a farm, something else having thousands of animals slaughtered every day in a single plant.

Coming to a more emotional side, it has been also found that generally speaking, the word "natural" is linked to something familiar and traditional that evokes nostalgia and attachment to culinary traditions of childhood that gives a perception of genuine. [138]

Some people were concerned about the fact that clean meat will bring to the loss of culinary traditions. Saying that cultured meat will harness traditional culinary tradition is like saying that cooking the grandma's recipe with a supermarket bought chicken or beef or whatever ingredient, is changing the family tradition. Moreover, given the level of globalization and connection between countries and cultures, today, in modern societies individuals' diets have become much more varied and food consumption patterns undergo the influence of different ethnicities identifiable in each society. Changes are necessary and it is not possible to avoid them, especially, in a so fast developing society. It is clear that we don't consume the same kind of animal that was available on the market fifty years ago, those same animals today are fed and treated very differently than they used to be, and as well, the meat processing after the animal is slaughtered has undergone several important changes.

In another research, unnaturalness has been found to have two different possible meanings in consumer mind: it can either derive from the perception of unknown consequences on health and environment of the technology

[137] Rothgerber, H. (2014). Efforts to overcome vegetarian-induced dissonance among meat eaters. Appetite, 79, 32–41. doi: 10.1016/j.appet.2014.04.003

[138] Valérie Burri, R. (2009). Coping with uncertainty: Assessing nanotechnologies in a citizen panel in Switzerland. Public Understanding of Science, 18(5), 498–511. DOI: 10.1177/0963662507085163

used to produced it, or, it can be more a conceptualization of unnaturalness as inherently unethical and therefore bad. In the first case, getting familiar with the product and evidences of its benefits can have a significant impact with the acceptance problem, meanwhile in the latter case, it is something irrational and it is more difficult to address with evidences.[139]

Therefore, considering the number of studies that confirm "unnaturalness" as a primary factor in the rejection of clean meat, identifying effective ways to describe clean meat not as a "high-tech product" may be crucial to its success. To this aim, what could be effective is start convincing consumer about the "unnaturalness" of conventional meat.

To this regard, a study conducted in 2016 has tried to identified the best strategy to overcome this barrier and the most effective found by this study was the "embrace unnaturalness" strategy which consisted of comparing other products that also seem unnatural but are however largely accepted among consumers. Interestingly, it also increased their willingness to pay and those that showed the major shift in minds were those that at first were the less interested in buying clean meat.[140]

2.7 Consumer acceptance of clean meat in Italy

Eating is a biological need and at a very basic level it occurs in response to a hunger stimulus. However, what a person tends to eat has a lot to do with geographical, social, economic and religious factors that all together represent the inherited culture of a population. It is undeniable that culture, in fact, is one of the major determinants of what a population dietary pattern looks like and food choices reflect the aim to satisfy both biological and social needs.

In some countries more than in others, there is a strong culinary tradition, that is part of a population's identity and even if nowadays due to globalization there is a strong influence among countries in relation to food, and the chance of eating different products coming all over the world is facilitated by trades and transportations, there is still some kind of traditional footprint. Food-related practices contribute to the foundation of one's identity since childhood, when children learn from their families and get used to certain foods and eating habits not only regarding what kind of food to eat, but as well appraise things such as number of meals per day, meal times, portion size, that will probably be, at least to some degree, carried on during their life time.

There are evidences that the environment people are exposed to impacts eating habits and not only family but as well peers and friends, have impact on this appraisal. This affects as well the degree of healthiness and sustainability of someone's diet. Since the world today is more interconnected and it is easy to find different

[139] Laestadius, L.I. Public Perceptions of the Ethics of In-vitro Meat: Determining an Appropriate Course of Action. J Agric Environ Ethics 28, 991–1009 (2015). DOI 10.1007/s10806-015-9573-8

[140] Macdonald, B., & Vivalt, E. (2017). Effective strategies for overcoming the naturalistic heuristic: Experimental evidence on consumer acceptance of "clean" meat. doi: 10.31219/osf.io/ndtr2

ethnicities in the same country, eating patterns are often a combination of someone's inherited family culture and the multi-cultural environment they are exposed to.[141]

In fact, culture involves change. Even if each generation learns and acquires the culture it is born into, it is never exactly the same as its predecessor, since to exist, culture needs the socialization process that involves influences among individuals and, in a broader scope, populations. Food is part of this dynamic process and even in a country as Italy, with such a strong and long-established culinary tradition and that has made of it an important point of pride recognized worldwide, and has a deep attachment to its roots, new generations are constantly more open to different foods.

However, when it comes to a disruption strong as cultured meat there can still be a high rate of rejection toward change.

To the aim of understanding what kind of acceptance will be encountered in Italy, before presenting a direct investigation on cultured meat it could be useful to consider the results of a study that has researched the acceptance of another important disruption through a "novel food" in the food context, that is insect's consumption.

The study has analysed the attitude of two different countries, Italy and Denmark and the results has showed that both intention and the consequent behaviour toward insect's consumption, where higher in the Danish sample. As an explanation of the difference among the two countries, the pace of change in food cultures has been taken in consideration. Italy has a much stronger food culture that even if has undergone some slight inclusive changes and people around the country are starting to introduce and embracing in their diets new products, especially those considered "functional foods" or creating new dishes with multi-cultural influences, in those changes and adjustments they still have a traditional approach and pay particular attention to gastronomic and nutritional quality to meet their own standards. In comparison, the Danish population over the past years has passed through significant variations also for what it concerns innovative cooking approaches, and is therefore more willing to try new products.[142]

However, this comparison has to be considered only for the "novelty" feature of the food that can may raise fears and rejection reactions, but cultured meat and insects are obviously very different products. One main difference is the perception of dirt. Insects, as explained in the research, are naturally linked to something dirty meanwhile cultured meat, also called clean meat, doesn't present this association. Dirt, when associated with food, has obviously a very negative impact and can represent under certain aspects, a more difficult barrier to overcome.

As previously illustrated, across different studies on cultured meat there has been one barrier found to be common to all of them, the perception of unnaturalness. Italy is keen on the Mediterranean diet that is, on the

[141] Larson, Story, M. (2009). A Review of Environmental Influences on Food Choices. Annals of Behavioural Medicine, 38(S1), 56-73. doi:10.1007/s12160-009-9120-9

[142] Verneau, F., Barbera, F. L., Kolle, S., Amato, M., Giudice, T. D., Grunert, K. (2016). The effect of communication and implicit associations on consuming insects: An experiment in Denmark and Italy. Appetite, 106, 30-36. doi:10.1016/j.appet.2016.02.006

contrary, perceived as very natural and genuine. Therefore, when the early media coverage has addressed this new meat alternative mostly as a new technology framing it as a "high-tech" concept instead of highlighting the societal benefits, this could have even reinforced this barrier among the Italian population. Nevertheless, according to early findings in 2005, surprisingly Italians were among the most favourable citizens in Europe regarding cultured meat as an alternative to slaughtering.[143]

In every context, it is important to frame the offer accordingly to the consumer information processing, and when it comes to a product whose main goal is to reduce environmental harm and that could therefore fall within the "green" product category, those benefits should be enhanced making the consumer feel empowered and highlighting his own environmental impact.[144]

In 2019 in Italy has been conducted a study on consumer acceptance of a cultured burger among 525 individuals under the aspects of willingness to try it, buy it and pay for it (Mancini, Antonioli, 2019). The research was undertaken submitting a questionnaire with four section: the first part with sociodemographic information collection; the second part involved meat consumption habits collection, investigating whether they were or not meat eaters and about their intention to reduce meat consumption; in the third part, after having provided participants with information about cultured meat with both text and images and describing firstly the production process and then the positive impact of the product, they were asked to evaluate attributes of safeness, tastiness and nutritional value perception, and extrinsic attributes of perceived animal friendliness, the potential to stop world hunger and natural resource preservation; lastly, in the fourth part was measured participants willingness to buy, try and pay.

The willingness to pay was aimed to understand whether consumers after having been acknowledge about the positive impact of the product were willing to pay a price premium and if so, in which amount or if they would try it only if the price was same as the one of conventional meat or even lower.

Results showed that regarding meat consumption and the intention to reduce it, the major reason for reducing their meat intake was health, followed by animal welfare and environmental reasons. Surprisingly, cultured meat resulted to be quite known among Italian consumers with 66 % of them, having at least heard of it. About the perception of cultured meat attributes, participants were more positive toward the extrinsic attributes as animal and environmental welfare meanwhile they were quite sceptical about taste and nutritional performances when compared to a conventional burger.

In general, age, education level and geographical location impacted the perception of the products attributes meanwhile no differences were found in gender. Highly educated, younger participants (under 25) from the Northern part of Italy were appreciating more the product and recognized its potential benefit. Gender, indeed,

[143] Eurobarometer, S. (2005). Social values, science and technology. Eurobarometer Special Report, 225 http://observatorioreligion.eu/upload/97/63/Special_Eurobarometer_225_Social_values__science_and_technology.pdf

[144] Cho, Y. (2014). Different Shades of Green Consciousness: The Interplay of Sustainability Labelling and Environmental Impact on Product Evaluations. Journal of Business Ethics, 128(1), 73-82. doi:10.1007/s10551-014-2080-4

influenced differences in willingness to try. Even if more than half of the participants stated they would try the product there was a significant male prevalence in the willingness to do so.

As for the attribute's perception, younger age and higher educational level impacted positively the intention to buy and previous exposure to information regarding cultured meat played a positive role as well. For what it concerns willingness to buy, almost half of the participants showed this intention and among those, 23% were ready to pay even a price premium.

This study suggests that there is potential positive acceptance of cultured meat in Italy and that the participant perceptions are more positive towards the extrinsic than intrinsic attributes of cultured meat and that the potential consumer of cultured meat includes young (under 25), highly educated and previously informed participants.[145]

In framing the communication of information around cultured meat, it is important to be clear but not to technical in order to not reinforce the negative perception of a high-tech product, that is not desirable in the food context. It is then necessary to underline the benefits for health and safety but also give more importance to taste performance, since when it comes to food consumers are not ready to compromise on taste and in this and other researches it appeared that taste is a feature about which consumer are very doubtful regarding cultured meat. Improving the communication of taste performance needs to be a top of mind interest for companies.

[145] Mancini, M. C., & Antonioli, F. (2019). Exploring consumers' attitude towards cultured meat in Italy. *Meat Science, 150*, 101-110. doi:10.1016/j.meatsci.2018.12.014

CHAPTER 3

Terminology issues, regulatory challenges, labelling and packaging insights and emerging opportunities for the clean meat market

3.1 Terminology

Terminology is important in the framing of how things are understood. The name that is given to an object or to a product or even people's names, can influence the evaluations process and the impressions an individual will form about it. In the food business many products, even if conventional items, can happen to have misleading labels for the consumer, who may end up buying a product that has not the characteristics he thinks or even have different health-related features.[146]

The name needs to have an easily explicative function of the product, trigger positive attitude since, before the trial moment and a deeper information seek, it is the first cue of the item with which the consumer comes in contact with.

Specifically in the case of meat, it has been shown that naming meat dishes in restaurants with the animal name as "cow" or "pig", increase the disgust feeling and more importantly the perception of the meat as an animal, increasing that unwilled effect of a troublesome behaviour and intensifying the meat-paradox effect. Therefore, using words as beef and pork was preferred. [147]

When a novel name for a product is created, such as in the case of Clean Meat, it is a new name with the aim to express and contain several information about the product, saying more about its inherent characteristics.[148]

As mentioned in the chapter before, people often use "anchors" to make decisions and to make sense of reality especially when the context is difficult to understand with purely cognitive and computational abilities. The outline of the production process of the clean meat can make it perceive as complicated and therefore, the name needs to give an anchor to the consumer, from where to easily make sense of the product. The importance of naming assumes even a major role in this case, as with any product that is technically advanced since people often experience a certain level of "technophobia" with new technologies that they not understand and perceive it as risky.[149]

Under a more technical point of view in the field of terminology, when it comes to clean meat, first of all, it is necessary to discuss whether or not products such as plant-based meat and cultured meat have the right to be

[146] Sütterlin, B., & Siegrist, M. (2015). Simply adding the word "fruit" makes sugar healthier: The misleading effect of symbolic information on the perceived healthiness of food. Appetite, 95, 252-261. doi:10.1016/j.appet.2015.07.011

[147] Kunst, J. R., & Hohle, S. M. (2016). Meat eaters by dissociation: How we present, prepare and talk about meat increases willingness to eat meat by reducing empathy and disgust. Appetite, 105, 758-774. doi:10.1016/j.appet.2016.07.009

[148] Körtvélyessy L., Štekauer P., Zimmermann J. (2015) Word-Formation Strategies: Semantic Transparency vs. Formal Economy. In: Bauer L., Körtvélyessy L., Štekauer P. (eds) Semantics of Complex Words. Studies in Morphology, vol 3. Springer, Cham

[149] P. Shapiro (2018), Clean Meat. How growing meat without animals will revolutionize dinner and the world. Gallery Books

called with the term "meat". FAO defines meat as ""all parts of an animal that are intended for, or have been judged as safe and suitable for, human consumption".[150]

Even if among countries there can be slight differences in the definition with some limitations or enlargements of the meaning, one common trait is that meat should come from a part of an animal. Under this definition, the living cell used for cultured meat, could be considered as a part of the animal and even the American National Cattlemen's Beef association has agreed that cell-based meats can be considered a "meat product" but not be labelled as "beef" that should stick only to products derived from cattle, but more issues could be found in the case of plant-based meat.[151] The problem is that till plant-based alternatives to meat were clearly different in taste, texture and appearance from conventional meat, not referring to them as meat was understandable, but today new products has achieved incredible levels of similarity with conventional meat and companies such as the Impossible Foods and Beyond Meat offer is finding appreciation even among some meat eaters that desire to decrease their intake of animal products.[152] Therefore, referring to those new products as meat seems a natural evolution. However, some have argued that even cultured meat shouldn't be referred to as meat but as "artificial muscle proteins" since meat should involve maturation inside an animal meanwhile, the product which is produced by stem cell culture is under a technical point of view muscle tissue.[153]

Clean Meat has not always been the only name of this product and today the most appreciated term seems to be cultivated-meat. Jason Matheny[154], the founder of the New Harvest, the world first research institute of cellular agriculture and at the same time the one thanks to which the Dutch government agency funded cultured meat research from 2005 to 2009, through media interviews detected that the first name chosen, that was "in vitro meat", even if being scientifically accurate, doesn't had a positive effect. As he stated "it is as calling table salt, sodium chloride", the effect is totally different.

The connection people immediately made when hearing the word "in vitro" was in vitro fertilization, that is definitely not a desirable image when related to something destinated to eat. There were other names tested, lab-grown meat, synthetized meat, test tube meat but all generated the same reaction of rejection. This was also the case in which the barrier of unnaturalness has been mostly detected.

After having understood that scientifically correct naming was not inspiring the desired effect, a different approach has been tried to appeal the environmentally concerned costumers: green meat. But it was rapidly clear that green when put near meat, was not inspiring something environmentally friendly but something rotten. Then it was the turn of "hydroponic meat", since American costumers have been accustomed to hydroponic tomato and were also connecting it with a lower use of water. However, it was still too technical.

[150] Food and Agriculture Organization (2005). Code of hygienic practices for meat. (CAC/RCP58-2005).

[151] Greene, J. L., & Angadjivand, S. (2018). Regulation of cell-cultured meat. Retrieved from https://fas.org/sgp/crs/misc/IF10947.pdf.

[152] Fellet, M. (2015). A Fresh Take on Fake Meat. Can scientists deliver a meatless burger that tastes good and will not harm the planet?. ACS Central Science, 1(7), 347-349. doi:10.1021/acscentsci.5b00307

[153] Hocquette, J. (2016). Is in vitro meat the solution for the future? Meat Science, 120, 167-176. doi:10.1016/j.meatsci.2016.04.036

[154] https://www.new-harvest.org/about

In the end Matheny settled on "cultured meat" since people were already used to eat cultured foods such as yeast and yoghurt, but it was a decision based on personal consideration without any testing on consumers. The Good Food Institute years later, in 2016, conducted a survey and the term that had major acceptance was clean meat. The term was then adopted since it was describing the fact that, in comparison with conventional meat, it was purer and uncontaminated with growth hormones, pesticides or any bacteria and it created a connection with "clean energy" making it easier to the consumer to relate to the term.[155] The issue that could arise is that even there is a rising awareness of production process products and the interest in how animal are raised and treated, the majority of consumers still have some lack of information about more technical issues and therefore could have not the perception that conventional meat is at high risk of contamination and bacteriological outbreaks due to the characteristics of intensive farming. Therefore, understanding the use of the term "clean" in this context may raise some doubts in the correct reception of the message.

However, despite the efforts, in most context the product is still referred to as "in vitro meat" or "cultured meat".

In 2018, more recent investigations have found that also "cell-based meat" even if not presenting high ratings on appeal among consumers, has good descriptive features and moreover, is better accepted among meat producers that found "clean meat" as negative for the image of conventional meat and it is an important aspect to consider since one of the aims of cultured meat is to have the support and to work together with the meat industry. In fact, different start-ups have opted for cell-based meat when referring to their product. However, it had not a good acceptance among consumers and a very low appeal in the willingness to buy especially when compared with other terms such as "slaughter-free meat" or clean meat.[156]

It has been also considered of simply using the brand name of the producer with potential emerging trade names, as have been done in the plant-based industry. Beyond Burgers and Impossible burgers are trade names that have the aim to avoid generic descriptors of the product such as "veggie burger".[157]

Then, in 2019, the Good Food Institute, that put a lot of effort in the ongoing research of acceptance of the product, has done another investigation with the aim to find a term that would pursue three main goals: neutrality, understandability and appeal. Terms that were tested were "cultured", "cell-based", "cell-cultured" and "cultivated". The first one recorded higher success than the second and the third one, but some issues were raised since cultured is already linked to fish aquaculture or was interpreted as something aged or fermented such as yoghurt. The last one, cultivate rated high both on descriptiveness and especially on consumers' appeal. It has been detected that the term "cultivated" inspire images of agriculture and, even more important to the

[155] P. Shapiro (2018), Clean Meat. How growing meat without animals will revolutionize dinner and the world. Gallery Books

[156] Watson, E. (2018). 'Cell-based meat' not the most consumer-friendly term, reveals GFI consumer research. Food Navigator USA. Retrieved from https://www.foodnavigator.com/Article/2018/09/30/Clean-meat-is-problematic-but-cell-based-meat-isn-t-perfect-either-reveals-GFI-consumer-research

[157] Stephens, N., Sexton, A. E., & Driessen, C. (2019). Making sense of making meat: Key moments in the first 20 Years of tissue engineering muscle to make food. Frontiers in Sustainable Food Systems, 3(45), https://doi.org/10.3389/fsufs.2019.00045

context, of natural processes. Moreover, it is scientifically correct and it is not used by other food types, incorporating that uniqueness characteristic that is important in product definition.[158]

The need of standardization in terminology is necessary to solve ambiguities and to enhance consumer appeal and acceptance, as well as awareness of the product among investors and stakeholders that need a unique and clear identification mean. Moreover, it will facilitate regulatory issues and standards definition.[159] It is important to give a clear and unified name that well defines the positive aspects of the product since outside the scientific community, the artificial perception of the product has often brought to the use of terms such as lab-meat, synthetic meat, and Frankenstein meat.

In conventional meat, the consumer is familiar with the product and can easily distinguish between different levels of processing thanks to both appearance and common-sense. The content of cell-based products it's less intuitive and it is difficult for companies to communicate the level of similarity with conventional meat, as well as the structure and the composition of it to achieve acceptance. [160]

Thus, since terminology has such an important role in consumer perception, and considering that perceived unnaturalness is one of the most common barriers to its acceptance, not only the name given to the product should be examined but as well, the way in which the product is explained in promotion campaigns and advertising. The high technology involved, increased this feeling of unnaturalness and therefore it is important to describe the product with nontechnical terms for an easy understanding and emphasise the final product and its benefits instead of the production method.[161]

The ultimate aim is to find a word that con convey all that information increasing not only acceptance but also the companies' transparency perception.

3.2 Regulatory challenges and ambiguities in EU and in the U.S.A.

From discussions around terminology, it is possible to shift toward regulatory issues since one starting point raised around its regimentation is whether or not cultured meat is a product of animal origin.

One of the many questions raised on the issue, is related to the fact that there is a high disproportion between the dimension of the "raw material", the animal cell, and the culturing media, that thanks to recent research is animal-free. However, it is not a sufficient argument to claim that it is not an animal origin product, at most, some issues could and have been raised against calling it meat, but it is difficult to consider it as not an animal

[158] Friedrich, B. (2019). Cultivated meat: Why GFI is embracing new language. Good Food Institute. Retrieved from https://www.gfi.org/cultivatedmeat

[159] Tritscher, A., Miyagishima, K., Nishida, C., & Branca, F. (2013). Ensuring food safety and nutrition security to protect consumer health: 50 years of the Codex Alimentarius Commission. Bulletin of the World Health Organization, 91(7). doi:10.2471/blt.13.125518

[160] O'Riordan, K., Fotopoulou, A., & Stephens, N. (2016). The first bite: Imaginaries, promotional publics and the laboratory grown burger. Public Understanding of Science, 26(2), 148-163. doi:10.1177/0963662516639001

[161] Siegrist, M., Sütterlin, B., & Hartmann, C. (2018). Perceived naturalness and evoked disgust influence acceptance of cultured meat. Meat Science, 139, 213-219. doi:10.1016/j.meatsci.2018.02.007

product. However not calling plant-based meat substitute, and cultured meat, with terms that are generally used for meat, such a "burger", will make it difficult and confusing for consumers. Also, the majority of the scientific world agrees, that it is actually an animal product.

When it comes to the role of regulators, when new technologies have to be regulated, especially when they can have consequences on human safety, governments face the important choice whether to use existing rules and analogous specifics that are more immediate but could have the risk of making those new technologies out of specific regulatory categories and being incomplete and inappropriate, or creating new ones ad hoc, that on the other side, request more time, are difficult to elaborate when the technology at hand is particularly disruptive and present uncertainties in the resulting agreement with others involved entities.[162]

In the EU food system, cultured meat would require a pre-market authorisation, except "where the technique used falls under the scope of Regulation (EC) No 1829/2003 on genetically modified food and feed"[163] and as well an approval by the European Food Safety Authority (EFSA).

The precautionary principle, the so called "better safe than sorry" is generally applied, meaning that there is a propension toward limiting risk coming from the uncertainty novel food technologies or process can cause. Cultured meat falls with the scope of the Novel Food Regulation both for novelty in the product itself and in novelty in the production process.[164] This regulation is a directive that from 1997 requires food safety assessments of food that are novel, from a European perspective, for pre-market approval. It defines novel food as food or food ingredients that were not used for human consumption to a significant degree within the EU before 15 May 1997. [165] However, considerations on the fact that this regulation were not appropriate instruments for cultured meat were raised. The fact is that there is still a problem in well defining how the product should be considered. This impacts the regulation in many forms. Cell-based cellular agriculture brings together the discipline of cell culture and meat science. For what it concerns cell culture, there is a need to regulate cell sourcing and donation that are regulated only for the human context with medically oriented documents. There is the necessity to adapt those directives for cultured meat that is obviously something totally different with different use destination. Coming to the regulation of plants and facilities, consideration such as whether largescale bioreactors are considered agricultural facilities and, since those facilities will need to be located in high power zones, specific regulations on energy consumption should be created. Coming to the end phase of production, waste removal strategies will need to be defined as well.[166]

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[162] Stokes, E. (2012). Nanotechnology and the Products of Inherited Regulation. Journal of Law and Society, 39(1), 93-112. doi:10.1111/j.1467-6478.2012.00572.x

[163] Regulation (EC) No 1829/2003 of the European Parliament and of the Council of 22 September 2003 on genetically modified food and feed. OJ L 268, 18.10.2003, p. 1

[164] Petetin, L. (2014). Frankenburgers, Risks and Approval. European Journal of Risk Regulation, 5(2), 168-186. doi:10.1017/s1867299x00003585

[165] Regulation, H. A. T. (1997). Regulation (EC) No 258/97 of the European Parliament and of the Council of 27 January 1997 concerning novel foods and novel food ingredients. Off. J. Eur. Communities, 40, 1-7.

[166] Stephens, N., Silvio, L. D., Dunsford, I., Ellis, M., Glencross, A., & Sexton, A. (2018). Bringing cultured meat to market: Technical, socio-political, and regulatory challenges in cellular agriculture. Trends in Food Science & Technology, 78, 155-166. doi:10.1016/j.tifs.2018.04.010

Furthermore, as cultured meat is food, it is also subject to the general principles and requirements of food law in terms of responsibilities of the food business operators and traceability of the food, and to the provisions on food information to consumers in order to provide a basis for final consumers to make informed choices.

For what it concerns the regulation in the U.S.A., it has been argued that the regulation system follows the doctrine of "substantial equivalence". This model is used to decide whether a product of biotechnology is the equivalent to its natural counterpart. This framework seems inadequate since cultured meat should be regulated as a new product and livestock should not be considered as its the natural counterpart. The Food and Drugs Administration regulates every product that is supposed to be consumed as food and in regard to cultured meat, since it relies on replicating animal's cells, and that in 2008 the FDA's announced that cloned animals were safe for human consumption, and that cultured meat can be considered in the same way as cloned animals, there was no need for additional regulation.[167]

In March 2018 the FDA and the US Department of Agriculture (USDA) formalized their joint agreement and announced establishing a basic framework for "human food products derived from cultured livestock and poultry cells". The FDA will regulate the initial stage of collection and growth of cultured cells, meanwhile the USDA will regulate the meat production and harvesting, including the labelling. The product will be considered meat only when it passes to the USDA regulation stage. The agreement was introduced to legislation to be codified in the "Food Safety Modernization for Innovative Technologies Act" on December 2019.[168] However, further detailed requirements, along with labelling rules, are still at a "work in progress" stage. Till now no cultured meat product is on the market.

After regulating the product standards, the production process and the disposal of wastes, it will be necessary to define another important factor involved in the process: the land rescue. Till now there are no regulatory lines giving instructions on the transition from farm usage to free land. There is the need to develop projects of reforestation and rewilding since otherwise the soil, after years of treatments for farming production, will be dead.

There is also another important consideration to make. Massive international food corporations have the control over the majority of global food commodities. In order to make a shift and try not to give even more power to those entities it should be beneficial avoiding the patenting of key technologies for the production process, to ensure the widest distribution possible also among developing countries and not enhance even more the dependence of those countries on the developed ones.

[167] Schneider, Z. (2013). In vitro meat: Space travel, cannibalism, and federal regulation. Houston Law Review, 50(3), 991-1026.

[168] Kettlemann, S.A., Sachs, A. J., (December 24, 2019) "Senate Introduces Bill to Formalize Joint Framework for Regulating Cell-Cultured Meat Products". THE NATIONAL LAW REVIEW. https://www.natlawreview.com/article/senate-introduces-bill-to-formalize-joint-framework-regulating-cell-cultured-meat

3.3 Farmers' war

It has been clear from the beginning, that given the potential of new products such as plant-based meat and cultured meat, understanding the disrupting economic impact on conventional agriculture was an issue to deeply consider. There is the fear, and probably it is a justified fear, that once the product will be commercialized and distributed at a competitive price, and the technology will widespread, much fewer livestock farmers will be needed. In fact, one of the main aims of this technology is exactly this: the potential power of diminishing the harmful consequences of livestock farming. However, there are few chances that conventional farming will completely disappear, there will probably and hopefully be a downsizing of the industry but it will remain part of our reality. There will always be demand for conventionally farmed meat, the aim is to make cultured meat the highest supplier and farmers meat a minority. Even if a re-organization of the market will be necessary, when technological innovations, have the power to enhance human condition a change is necessary.

Farmers are starting to be worried about what this will mean for their profits. In February 2018 the US Cattlemen's Association presented a petition for not permitting to products such as cultured meat, that is not produced from a raised and slaughtered animal, to use the label meat or beef. They claim that the label beef or meat should have the function of informing the consumer that the product is derived naturally from animals and not grown in a laboratory. At the time of the petition, cattlemen's started to be worried by the threat cultured meat could represent since the evidences of ongoing reductions in production costs and the chance of those new products of being on the market in few years, make it become a possible direct competitor for meat harvested in the traditional manner. In the petition they address as well plant-based meat substitute with a specific referring to Impossible Foods and Beyond meat companies that shouldn't be authorized to name their products under meat or beef labels.[169]

It is clear that conventional meat producers are perceiving the upcoming risk that alternative meat can represent to their business. They are concerned about not having regulation that will protect their profits. Although they perceived a little win when in March 2018 the FDA and USDA decided that the labelling regulation of cultured meat will be under USDA responsibility, the decision whether a product will be labelled as meat or not depends on certain quality standards of the cells harvested.[170]

Another claim raised against new technologies in the food industry is that cultured meat increases the dependence on science and big corporations. The fact is, when CAFO's owners claim that they are threatened by this new technology and that it will cause harms to many involved business and workers, they may have

[169] US CATTLMEN'S ASSOCIATION (USCA). (2018). Petition for the imposition of beef and meat labelling requirements: to exclude product not derived from animals raised and slaughtered from the definition of beef and meat. FSIS Case No. 2018 Retrieved from https://www.fsis.usda.gov/wps/portal/fsis/topics/regulations/petitions

[170] US. Department of Agriculture (USDA) (2019) "USDA and FDA Announce a Formal Agreement to Regulate Cell-Cultured Food Products from Cell Lines of Livestock and Poultry". Retrieved from https://www.fsis.usda.gov/wps/wcm/connect/0d2d644a-9a65-43c6-944f-ea598aacdec1/Formal-Agreement-FSIS-FDA.pdf?MOD=AJPERES

forgot that the enlargement of the farming system made collapse the small family-run farms that were producing an amount of meat that became then not sustainable under an economic point of view and were constrained to sell their activities.

Progress and innovation bring to changes on the market, and now it is probably the time to change something in the food industry. What can be aimed as a desirable outcome, is that clean meat will substitute meat produced in CAFO's, freeing a lot of land and animals, and at the same time, small farmers will be able to get back in the business with new conditions and their products will, hopefully, gain back higher consideration.

Today, because of this "wherever, whenever" availability of products, the value of many things is underestimated. Returning to a situation in which it is recognized the real value of raising an animal, the time necessary to raise it with natural timings and in a condition that allows its natural behaviour, will give back to the product its value. Conventionally produced meat, and here with conventionally it is meant from a raised and slaughtered animal, not an animal living in CAFO's, should, in an ideal situation, have a price premium over cultured meat and plant-based meat.

The so feared by the farming business, "substitution effect" is not likely to happen rapidly and most of all is not likely to happen at a complete level. It already happened in the past that there has been a substitution transition were chemical synthesis substituted successfully natural products as alizarin in the madder industry and vanillin in the vanilla industry. The difference between those two items is that, meanwhile artificial alizarin has been able to completely substitute natural alizarin that was extracted from the root of madder plant and was able to create six different dying shades of red, in the case of vanillin, what happened was a coexistence on the market as competing, but separate products. The fact is that when it comes to dying, the consumer is interested in the colour and in the permanency performance and with chemical alizarin the difference in dying was impossible to denote, it was even outperforming on the permanency side. Instead, in the case of vanillin, because of a higher complexity of the product, even if the artificial flavour has reached a wide spread, the natural product continued to be superior, dividing potential target consumers in two categories and satisfying therefore different segments of the market.

A part from the complexity of the product itself, another factor is the timeframe of the transition. In the field of technology innovation, it is difficult to develop cost effective products in short periods. However, when a disruptive innovation is announced, traditional producers, as in the case of the livestock sector should prepare themselves, innovating as well and finding new ways and new features on which to be competitive with the potential innovation, regardless of its current success because once it will become successful it will be too late.[171] Therefore, since cultivated meat has been researched for many years now, conventional farmers should have found some alternatives to how to continue to stay on the market nevertheless the arrival of cultured meat, especially, knowing how unsustainable livestock production is.

[171] Burton, R. J. (2019). The potential impact of synthetic animal protein on livestock production: The new "war against agriculture"? Journal of Rural Studies, 68, 33-45. doi:10.1016/j.jrurstud.2019.03.002

However, as mentioned above, it could be an opportunity for those small farmers to become a kind of "luxury" producers. Challenge Advisory, a global strategy consultancy firm that collaborates with pioneers and innovators both corporate and institutional, when it comes to cultured meat opportunities is not afraid to claim that "if the trend of lab meat continues to be developed and if it reaches the point of mass adoption, the value of naturally grown meat will rise astronomically. Meaning, that meat that's directly derived from animals will become a luxury that will only be affordable to a small percentage of the population."[172]

Furthermore, the industry of cultured meat will need the livestock sector in order to have animals raised with some specific and proper safety standards from where to take the cells for the cultivation process. It could be hypothesized that a segment of farmers will possibly become a new kind of suppliers. This would even allow them to cut management cost of their farms, since they will need less animals to raise and avoid the costs of the slaughtering process.

The job landscape in the food industry will unavoidably go under a reorganization process and together with the challenges also new opportunities will come.

3.4 Packaging perception of naturalness and willingness to buy

A packaging wants to satisfy three purposes: a commercial function, as identification of the source, positioning and distinctiveness; a physical function since it has to contain the product, ensure the desired shelf-time and protection and permit transport; a social function that especially today has acquired major relevance as using recycled materials to reduce pollution. Those three purposes synthetize the functional and emotional elements a packaging needs to deliver.[173]

The ability of a label to have an impact on consumer attitudes depends on the degree to which it success to be clear and give meaningful information but, the definition of a meaningful information depends first of all on what is relevant to the consumer and then, on the individual's knowledge about that specific information. It is useless to write on the package very technical information that can hardly be understood and can, on the opposite, have the negative effect of a deterrent. The level to which a label influences the consumer decision-making process is correlated as well, to the belief in the message communicated and, if there are some specific certifications as organic or vegan, to the legitimacy of the certifying institution. Therefore, choosing the right mix of label elements is crucial to the consumer's point-of-sale behaviour.[174] When the right mix of elements is implemented, the label gains the power to reinforce the brand and increase consumer's trust especially when it concerns a product that is new for the consumer.

[172] Miskinis, C., (2017) "How The Trend of Cultured Meat Will Affect Farmers". Challenge Advisory. https://www.challenge.org/resources/lab-meat-impact-on-farmers/

[173] Rundh, B. (2005). The multi-faceted dimension of packaging. British Food Journal, 107(9), 670-684. doi:10.1108/00070700510615053

[174] Thøgersen, J. (2000). Psychological Determinants of Paying Attention to Eco-Labels in Purchase Decisions: Model Development and Multinational Validation. Journal of Consumer Policy, 23(3), 285-313. doi:10.1023/a:1007122319675

When it comes to food and especially to animal-origin food, labelling acquires particular importance since there are involved important features that ensure not only the quality of the product, but also its safety and the welfare of animals involved in the production process. In Italy, has been recently proposed by the Compassion in World Farming (CIWF) Italia Onlus,[175] that is active in trying to stop intensive farming operations, to impose a national labelling system that informs the costumer about the farming methods of the animals involved in the production process of a specific item. The initiative has not only the aim to inform concerned costumers but also to enhance the image of those farmers that treat animals better and take actions to improve their well-being and re-pay their efforts.[176]

In the food context generally, naturalness is linked to something good and healthy and is in opposition to something processed. Consumers acceptance of products is often influenced by the perception of how natural a product is and this naturality is required to be found also in the production process.[177] As mentioned in the former chapter, one of the greatest barriers that has been found in consumer acceptance toward food products produced with new technologies, as cultured meat, is the perceived unnaturalness of the product. Therefore, if there is a way in which to overcome or at least to diminish, the strength of this barrier at the point of sale with decisions concerning the packaging features, it is an aspect that should be well thought and designed. The design of a packaging of any product, not only in the food context, is the visual trigger for the consumer and have an important role as vector of communication that in this case, needs to transmit the so desired naturalness or at least to make it perceive as a safe product with desirable characteristics and influence positively its evaluation.[178]

At the point of sale, it is important to reach consumers sight perception since it is the first contact that brings to subconscious responses triggered from visual cues as colours, logos, images and shapes that attract consumers' attention enabling them to make expectations more quickly than reading a written text through conscious understanding.

When consumers need to choose a product, they consider not only its functionality and the aesthetic but also its symbolic meaning and this meaning can be reinforced by how the product is presented at the point of sale. In fact, a packaging communicates not only brand personality but it is a tool through which, at a first glance, attract consumer's attention who will then categorize the product, depending on the positioning of the offer and on personal relevance for the costumer, and decide whether or not involve it in his consideration set.[179] The symbolic meaning that can be retrieved in the domain of eating habits, has many implications since

[175] CIFW ITALIA. https://www.ciwfonlus.it/

[176] Crepaldi, G. (May 25, 2020). "Benessere animale, un'etichetta sul metodo di allevamento: la proposta di legge presentata da Ciwf Italia, Legambiente e LeU". Il fatto alimentare. https://ilfattoalimentare.it/etichetta-allevamento-proposta-legge.html?fbclid=IwAR1vbMey0CbuDUz18tp2p-QQG8w6KSz0j5pfbERc2s8qbPPQW6GRR4aA4bg

[177] Rozin, P. (2005). The Meaning of "Natural": Process More Important Than Content. Psychological Science, 16(8), 652-658. doi:10.1111/j.1467-9280.2005.01589.x

[178] Bone, P. F., France, K. R. (2009). Qualified Health Claims on Package Labels. Journal of Public Policy & Marketing, 28(2), 253-258. doi:10.1509/jppm.28.2.253

[179] Belk, R. W. (1988). Possessions and the Extended Self. Journal of Consumer Research, 15(2), 139. doi:10.1086/209154

deciding to eat animal-free or even to just reduce meat intake implies several ideas that can go from healthiness, to environmental concerns to other deep meanings that implies the idea of the self.

As it has been explained earlier in this thesis, given the current situation of intensive farming production, meat coming from farmed animals can easily be considered to have lost its naturality at least to what it concerns the production process. However, there are still products on the market that are marketed with the typical colours, as green and light brown, that give a perception of naturalness.

It is important that the information given about the product is clear and unambiguous in order to increase trust perception and transparency.[180] In the case of food, providing packages that permit to see what is inside, especially when it is a new product on the market, is important to make it easier for the consumer to understand what is it and whether he can be interested in buying it.

For instance, plant-based burgers traded by Beyond Meat (Image 1.) have transparent packages with green and light brown colours, that first of all give the consumer the chance to see that the burger is actually very similar if not identical to a conventional burger, and secondly, thanks to the use of specific colours easily position it in the "green" or "healthy" or "environmentally friendly" category.

Then the consumer can find other information such as the content of fat and the content of protein that for many consumers is an important choice factor. Many meat-eaters are in fact worried that cutting meat off their diets will not ensure them the right amount of proteins and iron.[181]

Image 1.

Retrieved from https://www.beyondmeat.com/products/the-beyond-burger/

The information on the packaging want to inform about the benefits the product can deliver both psychologically and physically.

In order to make those information easily comprehendible for the consumer and immediate to catch, especially in context such as a supermarket, that is full of products and the consumer is usually not likely to spend lot of time to compare all the products and all the labels, several signs can be put on the packaging to envision functional elements. In the case of plant-based products, there are specifics logos to inform consumers that it doesn't contain any animal-derived ingredient as the sign "vegan" and if they are organic there are specific labels and logos to signal it. Other signs that can be used are health claims as no artificial additives or no antibiotics, and origin indication. The latter is compulsory on any product but the producer can decide to use

[180] Silayoi, P., Speece, M. (2007). The importance of packaging attributes: A conjoint analysis approach. European Journal of Marketing, 41(11/12), 1495-1517. doi:10.1108/03090560710821279

[181] Lea, E., Worsley, A. (2001). Influences on meat consumption in Australia. Appetite, 36(2), 127-136. doi:10.1006/appe.2000.0386

it as a point of advantage under a marketing point of view, given the importance production location can acquire for many consumers, and make it more highlighted on the front of the package.

Quality labels have become an additional tool used by producers and started to be more common in recent years. When it comes to quality, the attribute is referred not only to the qualities that are intrinsic to the product itself, but as well to other aspects such as environmental, economic and working condition under which the product has been manufactured.[182] In the contest of cultured meat distribution, quality labels can and should be included on the packaging especially to enhance that perception of "clean" as free from antibiotics, animal suffering and environmental pollution, that are the aims pursued by producers.

Another aspect intrinsic to food products, is that it is an experiential good, which involves that consumers cannot try it before having purchased it and used. In fact, a part from some situations when in supermarkets there are in store free-trials, generally, whether or not a specific product is liked is known only after the purchase.

In this kind of goods, attractiveness of the product and more specifically of the packaging has a key role on first impression and willingness to buy. It has been demonstrated that there is a connection in the packaging design and the evaluation of the product since it can enhance both the quality perception and the potential benefit delivered by the product.[183]

When there is the desire to increase the chance that people make decisions toward a healthier and more sustainable lifestyle, the packaging needs to be in line with the product. The material used for the packaging is considered to be one of the elements that forms a part of the visual appearance and influence the way in which consumers perceive the product and infer ideas about its characteristics.

The sense that are predominant when evaluating a product through its package are sight and touch. It has been found that using a sustainable material positively influences not only the perceived ethicality of the brand but also the willingness to buy and especially, when this sustainability is perceived contemporary at a touch and sight level.[184]

If the product is described to be sustainable but then the packaging is not, environmentally aware consumers can feel a sort of dissonance that can even result in a perception of low trust toward the brand or any positive claim made further on the product. This is what has happened, even if not with a high resonance, with the first Beyond Burger packaging. If it is a good example of the use of colours, transparency, logos and information,

[182] Golan, E., Kuchler, F., Mitchell, L., Greene, C., & Jessup, A. (2001). Economics of Food Labelling. Journal of Consumer Policy, 24(2), 117-184. doi:10.1023/a:1012272504846

[183] Creusen, M. E., Schoormans, J. P. (2005). The Different Roles of Product Appearance in Consumer Choice. Journal of Product Innovation Management, 22(1), 63-81. doi:10.1111/j.0737-6782.2005.00103.x; Orth, U. R., Malkewitz, K. (2008). Holistic Package Design and Consumer Brand Impressions. Journal of Marketing, 72(3), 64-81. doi:10.1509/jmkg.72.3.064

[184] Magnier, L., & Schoormans, J. (2015). Consumer reactions to sustainable packaging: The interplay of visual appearance, verbal claim and environmental concern. Journal of Environmental Psychology, 44, 53-62. doi:10.1016/j.jenvp.2015.09.005

many consumers claimed the unsustainable material of the packaging especially because of its difficulty to be recycled and because of the high quantity of plastic involved.[185]

It is acknowledged that packaging which is perceived as more respectful of the environment has positive repercussion on the consumers preference and attitude, and in the case of clean meat, using green materials would have a positive impact.[186] The aim of cultured meat is to reduce the impact that meat production causes every year and all the aspects around the product should be in line with this mission to fit the big picture in the eyes of consumers.

Efficacious labelling could facilitate consumer choice and induce a sort of compromise in the acceptance of new technologies. Therefore, even explicit information on the degree of sustainability of the packaging can be adopted as a reinforcement of the brand concept.

3.5 Ethical considerations of clean meat

As the commercialization of cultured meat is getting closer to become reality, and since it has been largely spread around media making it accessible to public opinion, it is predictable that some ethical concerns about this new product would have risen. When a food product is new on the market, usually public acceptance is influenced by features such as the taste, quality of ingredients and other tangible aspects that are typical of the category but, with cultured meat, scientists and manufacturer have to handle also another aspect, an intangible one, as the perceived ethicality of the product.[187] It is necessary to understand public perception across all the different aspects it can touch in order to achieve knowledge in how their ethical concerns can develop, what kind of consequences it can mean for the product's success, and with what kind of course of action to take in order to prevent them. The ratio is that making the product more in line with public values is important both in relation to the ongoing development and for an appropriate promotion of the product through media.

Cultured meat is a novel approach, and as every novel approach it raises some questions and doubts especially since it is related to a very rooted concept as the way human beings nourish themselves. Usually, people deal with novel technologies making a connection with another technology with which they are already familiar, so it has been hypothesized that since people are already familiar with other kinds of industrial meat processing, it would represent a facilitator, but instead, in the case of cultured meat, there has not been an association with other kinds of processing that would ease the costumer with the product.[188]

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[185]Change.org Petition. "Ask Beyond Meat to reduce plastic packaging" https://www.change.org/p/beyond-meat-ask-beyond-meat-to-reduce-plastic-packaging?source_location=topic_page

[186] Rokka, J., & Uusitalo, L. (2008). Preference for green packaging in consumer product choices - Do consumers care? International Journal of Consumer Studies, 32(5), 516-525. doi:10.1111/j.1470-6431.2008.00710.x

[187] Dilworth, T., & Mcgregor, A. (2014). Moral Steaks? Ethical Discourses of In Vitro Meat in Academia and Australia. Journal of Agricultural and Environmental Ethics, 28(1), 85-107. doi:10.1007/s10806-014-9522-y

[188] Marcu, A., Gaspar, R., Rutsaert, P., Seibt, B., Fletcher, D., Verbeke, W., & Barnett, J. (2014). Analogies, metaphors, and wondering about the future: Lay sense-making around synthetic meat. *Public Understanding of Science, 24*(5), 547-562. doi:10.1177/0963662514521106

The fact is that biotechnology applied to food should be considered as the latest achievement and the natural consequences of scientific and technological development rather than something completely new. However, to those that show reluctancy toward cultured meat, what cannot be ignored, is that it also represents an incredible opportunity to reduce the harm from meat consumption. Moreover, conventional meat consumption itself raises several ethical issues, and for instance, animal advocates that are the greatest opposers to farming, even if consider plant-based diet more preferable as an approach for reducing meat consumption, many of them is favourable to the commercialization of cultured meat since it represents the ‘‘trade-off between the ideal and the practical’’ since a worldwide veganism is unrealistic and cultured meat can eliminate the need for a radical dietary change.[189]

As for likability and acceptance, that are two concepts which for some customers are linked to moral and ethical concerns, the unnaturalness perception plays a significant role even in relation to deeper considerations. The negative perception of unnaturalness that raises from altering food with technological processes as biotechnology, has more profound effect than a first impression rejection and feeling of disgust, it is the driver that raises many of the current ethical concerns, first of all the one of maintaining a “natural” food system.[190] The fact is that through history there has often been a sort of moral credence that there should be limits placed on mankind’s capacity to change nature at its deepest level. Moreover, being natural is not always synonym of being good for human health. There are even in nature many substances that are lethal for humans meanwhile cultured meat can be artificially made but with a well-designed process can be much healthier than conventional meat or than not eating meat at all, since meat contains also beneficial substances for the human body.

On the other side, there is the ethical concern that can be found in the “meat-paradox”. People love animals but eat meat. If they have to think of and realize how animal are slaughtered, and face the reality that the chicken breast in the supermarket is not a “thing” but it was once a living animal, they may have some troubles and even if those “moral moments” are adjusted with automatic justifying processes that can correct this dissonance, even the more convinced meat eater would prefer not to talk about the sources of meat and slaughtering practice while enjoying their steak or chicken nuggets. The point is exactly this, people take joy from eating meat not from the animal suffering. Therefore, why not to consider that the solution can be something that allows people to eat meat avoiding animal death.

The fact that this dissonance exist, is the proof that ethical concerns with meat are a matter of fact in the perception of consumers and that cultured meat can be its solution. So, if on one side there are ethical concerns about cultured meat, on the other side, conventional meat ethical concerns can be the ground for considering cultured meat an ethical product due to its environmental and animal welfare benefits. The mental process that

[189] Stephens, N. (2013). Growing Meat in Laboratories: The Promise, Ontology, and Ethical Boundary-Work of Using Muscle Cells to Make Food. Configurations, 21(2), 159-181. doi:10.1353/con.2013.0013

[190] Frewer, L., Bergmann, K., Brennan, M., Lion, R., Meertens, R., Rowe, G., Vereijken, C. (2011). Consumer response to novel agri-food technologies: Implications for predicting consumer acceptance of emerging food technologies. Trends in Food Science Technology, 22(8), 442-456. doi:10.1016/j.tifs.2011.05.005

should be done, is that we already use technology to enhance and facilitate other aspects of human life, from medicine to transportation, to green energy, and avoid bad things we don't like and are considered as potentially harming. Given that there are several and not negligible things that are bad about meat consumption as animal suffering and death, environmental harm and threats to human health, viewing technology as the fixing tool should support the promotion of culture meat.[191] In the food context, against the use of technology as a fixing tool, has also been claimed that this kind of behaviour leads to selfishness instead of a virtuous and sacrificing attitude that is considered to be superior. The fact that with cultured meat we refuse to stop from eating meat and we satisfy our "vice" in another way, is perceived as a sign that we wouldn't do the right thing if it means to make some sacrifice. But, is boosting our own virtue more important than releasing animal suffering and reducing environmental harm? More than probably not. However, among the majority of consumers, that are more worried about having a suitable substitute satisfying in taste and safeness, than about being virtuous, once the benefits of cultured meat are understood, this kind of moral issues should remain at a more academic and philosophical level. In practice, it is important to consider those ethical concerns that have an impact on further mass acceptance.

One can also argue that dismissing all the farming factories will impact the animals involved in the process worrying about their destiny once they won't be necessary anymore for meat production and as well whether this change will bring to some ecological disruption, due to soil treatments and biodiversity loss. It is clear that livestock animals are dependent on the care of humans and are not exactly wild animals that can be left free in nature from one day to another. Obviously, all these animals will not be killed or left starving because not serving for the meat industry anymore simply because, the transition to cultured meat is not happening all in a sudden. It is a process that takes time and will take a few generations to achieve the coverage of at least the majority of meat consumption. There will probably be a long period of coexistence in which there will be a diminishing rate of replacement of slaughtered animals with new born animals, at least in intensive farming operations. Before the enlargement of the farming industry there were cows and pigs and chickens, only in a smaller number. They still were existing and they will continue to exist, just in a smaller amount that was and will be again, much more sustainable.

Then it comes the issue of animal dignity. Animal advocates can raise the issue that eating cultured meat is if not physically, symbolically harmful to animals as a violation of their dignity since it is violates its integrity and it demonstrate a lack of moral regard toward the animal. Animal integrity is considered violated when human intervention alters its species-specific balance or if due to the intervention, it has no longer the ability to survive in an environment suitable for the species.[192] But in the case of cultured meat it is not the animal to be changed in something else. The tissue created from the cell is not a new animal or a changed animal. It is

[191] Hopkins, P. D., & Dacey, A. (2008). Vegetarian Meat: Could Technology Save Animals and Satisfy Meat Eaters? Journal of Agricultural and Environmental Ethics, 21(6), 579-596. doi:10.1007/s10806-008-9110-0

[192] Bovenkerk, B., Brom, F. W., & Bergh, B. J. (2002). Brave New Birds: The Use of 'Animal Integrity' in Animal Ethics. The Hastings Center Report, 32(1), 16. doi:10.2307/3528292

difficult to argue that taking a cell from the animal represents a lack of moral regard meanwhile treating the animal as just a source of food is not. If culturing animal cells is perceived as disrespectful toward the animal that objectifies it and instrumentalize it, how making live the animal a life in the conditions they currently do, is not? To show respect to any creature it must be treated more than just a mean and certainly a fully plant-based diet would be the response to this argumentation. But if the choice is between the way how millions of animals are being treated in contrast with the chance to need much less animals for cell culturing, considering as well that animals will be involved only in an initial stage since the very last aim is to obtain a sort of cell stockage that make those cells to duplicate themselves to infinite, without the need of extracting them from animals anymore, cultured meat must seem the better alternative. Moreover, the conventional meat production treats the whole animal as a mean, not just parts of it. It will be the product of treating cells of the animal that are no-sentient beings, as a mean to satisfy people's nutritional and pleasure-related needs and not the life of the whole living and conscious animal that is a sentient being, that will be allowed to continue with his life. People donate blood, organs and tissues and it is not considered an instrumentalization. Therefore, why taking cells from animals in order to make food, without harming the animal, should be. People, in order to overcome the meat-paradox, already tend to disembody the meat product as meatballs, steaks, nuggets can be, from the animal, making it become something that doesn't come from a living, feeling being that has been killed. Cultured meat makes this disembodiment and detachment real and not just a mind creation for finding moral justification for the unwillingness to stop eating meat.
The great achievement that cultured meat allows it separating meat from animals and humanity should give it a chance.

3.6 Emerging opportunities and current market situation for clean meat

Today, innovations in cellular agriculture, the raising interest in animal welfare and environmental sustainability combined with the increase of meat consumption and an apparently weak willingness to diminish this consumption in the early future, at least for the majority of world's population , represent important drivers for the growth of the cultured meat industry that can build upon those developments their future opportunities and set important goals.
Looking at the current market landscape, and the day by day increasing importance that is given to social responsibility among companies, it seems that businesses have accepted that they need to take action to reduce human impact on earth by adopting new methods and taking the opportunity that new technologies are offering, to be competitive on the market. MarketsandMarkets, a global market research and consulting firm that publishes strategic analysis reports, has estimated that in 2025 the global cultured meat market will be valued 214 million dollars and will reach 593 million by 2032 given the increasing interest in the subject that

attires important investors of the food industry such as Cargill and Tyson Food.[193]According to the report, there will be important opportunities especially in the poultry business, since it is a product that is facing a growing popularity, in particular in North America and in the U.S. where nuggets seems to be the primary form in which poultry is consumed. North America is also likely to dominate the market given that they have the larger investments availability and a good acceptance for meat substitutes. The Israeli Future Meat Technology, in which the American TysonFoods company and then Chicago's S2G Ventures (the company that has financed Beyond Meat's IPO), have invested, has been the first one to approach poultry production and in October 2019 announced that by the end of 2020 they will have a pilot factory outside Tel Aviv that will allow to decrease to under 20 euro per kilogram the cost of their product, that will be a hybrid between plant-based and cultured meat.[194] Another important player on the Israeli scene is Aleph Farm co-founded with the food-tech incubator The Kitchen Hub, that has claimed to have been able to create the first steak in July 2019 (before, all cultured meat products were minced meat since achieving the texture of a whole piece requested more competence). The product currently cost 45 euro per steak and the testing stage should be starting in 2021 and be officially on the market on 2023 with a definitely lower price.[195] Through their website, it is possible to catch their intention to communicate their values and the idea that they want to engage costumers in this transformational process of the food industry and this cultural change toward a more mindful and quality-oriented way of eating. They focus on trust and transparency both through describing clearly their techniques and the related benefits of culturing meat with text, images and as well, offering the chance of a tour, launching their Visitor Centre program and the Z-board that is an exchange idea-platform for very young people born between 1995 and 2015 to open up to dialogue for this younger generation since the company values building a sustainable future as an "obligation" for the new generation.[196]

Coming to Europe, in February 2020 the Dutch Mosa Meat, that has released the world's first lab-grown hamburger in 2013, has announced to be partnering with Nutreco, that has expertise in managing manufacturing supply chain at a global scale, and with a US venture capital fund, to set up the first plant and be ready for commercialization of its cultured beef products in 2022 even if on a very small scale.[197]

In the U.S.A the leader start-up for cultured meat is the California-based Memphis Meat currently building a pilot plant to produce different kind of meat from beef, to chicken, to duck on a large scale thanks to the latest funding round that achieved 161 million dollars. There is also another company in California that is working

[193] MarketsandMarkets. (September, 2019). "Cultured Meat Market by Source (Poultry, Beef, Seafood, Pork, and Duck), End-Use (Nuggets, Burgers, Meatballs, Sausages, Hot Dogs), and Region (North America, Europe, Asia Pacific, Middle East & Africa, South America) - Global Forecast to 2032". https://www.marketsandmarkets.com/Market-Reports/cultured-meat-market-204524444.html?gclid=EAIaIQobChMIkrLlgZfU6QIVlxoYCh11DgtuEAAYASAAEgIBXvD_BwE

[194] Staff, T. (October 10, 2019). "Future Meat Technologies to build lab meat production facility outside Tel Aviv". THE TIMES OF ISRAEL. https://www.timesofisrael.com/future-meat-technologies-to-build-lab-meat-production-facility-outside-tel-aviv/

[195] Pellman Rowland, M. (May 14, 2019). "Israeli Startup Aleph Farms Raises $11.65 Million To Create Steaks". Forbes. https://www.forbes.com/sites/michaelpellmanrowland/2019/05/14/aleph-3dprintingmeat/#2655ebf25e0c

[196] Aleph Farms. Meat Growers. https://aleph-farms.com/culture/

[197] Byrne, J. (January 9, 2020). "Nutreco gets behind Dutch cultured meat pioneer". FeedNavigator. https://www.feednavigator.com/Article/2020/01/09/Nutreco-gets-behind-Dutch-cultured-meat-pioneer

on a further innovation in the cultured meat sector, it is Artemys Food that is trying to achieve the production of creating animal fat that in terms of taste and texture will be a great improvement.[198] Even if adding plant-based fat is healthier in terms of cholesterol levels and digestibility, being able to create a product with at least a part of animal fat will make it easier acceptable for the consumer that is not willing to compromise on taste and however, the lab-produced fat is potentially healthier than the one of conventional meat. In fat tissues, environmental pollutants and other toxins are usually being stored.[199]

All those companies are working hard in order to achieve a competitive price and a high-quality product to be able to bring cultured meat on the market in a safe and accessible manner.

There are also other smaller realities in the cultured meat business, that are trying to achieve the aim of an animal-meat free world. For example, there is the French Gourmey, participating in Singapore-based foodtech accelerator Big Idea Ventures, that has born with the intention of producing cultured fois gras to avoid the cruel production process involved in the manufacturing of this luxury product. The company wants as well develop further to be specialized in all kind of duck products considering the Asian preference for this kind of meat in its culinary tradition.

Cultured meat is becoming a reality and there are many opportunities, as well as challenges, that companies can take. Especially in those latest months, the pandemic situation of Covid-19 that the world is sadly going through, has raised many issue and questions about the way we are treating our planet and as well, about the role of animal derived food in the spread of dangerous viruses.

If there is an important take-away that the public opinion, the governments and the scientific world all together can get from this situation that has already showed what kind of terrible consequences will bring under economic, social and health point of view, is that even if we have achieved terrific levels of development and technological advancement in weapons, smart-tech, automotive and others, there are invisible enemies that are even harder to combat. Considering how hard it is to develop a cure or a vaccine for a new and unknown virus, it is necessary to do whatever is possible to prevent this kind of situations. And even if specifically in this case, the epidemic hasn't started in a farm, there had already been other cases such as for the SARS in 2002 in China or the BSE, commonly known as the Crazy Cow diseases, or even in 2013 the PEDv among pigs arrived from China and that caused the death or forced the kill of 10% of American pigs in the USA, that have started from animals in farms and that, as with Covid-19 that has a zoonotic origin, were then able to rapidly mutate and attack the human body with consequences that can bring to death if not properly cured.

It has been recorded that in the USA and in other countries a particular diffusion of the Covid-19 virus has been registered in slaughterhouses. The reason why those work settings have been interested more than others

[198] Kateman, B. (February 17, 2020). "Will Cultured Meat Soon Be A Common Sight In Supermarkets Across The Globe?. Forbes. https://www.forbes.com/sites/briankateman/2020/02/17/will-cultured-meat-soon-be-a-common-sight-in-supermarkets-across-the-globe/#4fba5de77c66

can be due to its particular environmental condition. In slaughterhouse, large amounts of water are frequently used for cleaning in order to control the bacterial load that occurs due to the presence of animal blood and stool but this generates high humidity rates and the consequent higher steam level could have eased the diffusion of the virus through asymptomatic individuals. Moreover, there is also a social condition involved, the fact that the work in slaughterhouses is very hard and no many people are willing to do it so often workers in slaughterhouses are immigrants that are scarcely protected by syndicates or proper working contracts and are hired by cooperatives through illegal hiring with very low wages. Those people often live in very unsafe and unhealthy conditions, sharing those rundown courthouses with many others, allowing the spread of any illness much more rapidly.[200]

In those last months, the demand for plant-based meat, that is a product already better accepted by consumers compared to the potential entrance of cultured meat on the market, has faced a significant increase. In the U.S.A since March it has been registered a 234% increased demand for plant-based meat alternatives, compared with an only 45% increase of conventional meat and the same, even if not at these rates is happening in China were the concerns about the link between animal-origin product and the virus is bringing back citizens to plant-based product and this could sign an inversion in the recent concerning trend of rising demand for meat in those countries as China and India.[201]

The opportunity that this pandemic situation will give chance for a "new normal", that will hopefully make consumers more interested in safety issues and make the acceptance of cultured meat a faster and easiest process, is the justified hope of many suppliers in the industry.

[200] Grasselli, A. (May 22, 2020). "Macelli e coronavirus: la situazione dell'epidemia in Italia. Il parere di Aldo Grasselli". Il fatto alimentare. https://ilfattoalimentare.it/macelli-e-coronavirusitalia.html?fbclid=IwAR3j0F5ypTVwDvec4Ajrvldb0uP9gZzSIjZgy0ACHypeLYc6KKUoY_jMaq0

[201] Master, F. (April 27, 2020). "Coronavirus has put plant protein back on the menu for China". WORLD ECONOMIC FORUM. https://www.weforum.org/agenda/2020/04/plants-protein-coronavirus-safety-china/; Nieremberg, A. (May 22, 2020). "Plant-Based 'Meats' Catch On in the Pandemic". The New York Times. https://www.nytimes.com/2020/05/22/dining/plant-based-meats-coronavirus.html

CONCLUSIONS

The aim of this thesis was to bring attention toward some urgent situations that are affecting the world and that if not rapidly addressed will have catastrophic consequences for future generations. Specifically, the thesis reveals some aspects of the farming industry that could be efficiently solved with the introduction on the market of clean meat.

First of all, it has been showed that the current management of the food system related to the demographic changes, is not sustainable anymore and that it will probably face soon an emergency status. It has been therefore illustrated why livestock and intensive farming represent an important threaten to our environment being responsible for a large part of resource scarcity, water and air pollution, deforestation, spread of illnesses and not least, animal mistreatment. In a world with an increasing interest in environmental and animal welfare issues, what happens daily in concentrated animal feeding operations is not acceptable anymore. There is the need to end this kind of realities and look for other, new solutions.

The solution has been found in technology. People are used to technology as a mean of improving our daily life in many aspects. Technology has driven society to amazing developments and achievements, making real things that before were hardly conceivable but that today are commonly part of our lives. Well, clean meat is the latest achievement of the scientific world that is not involved in the way we communicate or we travel, but, in such a fundamental and intrinsic need of the human being as nutrition is.

The way how this new opportunity will be accepted by consumers and will have the chance to become a successful reality, a part from technical and regulatory challenges that are proper effort of the scientists and the institutions involved, will depend on the framing of this offer and on how it will be communicated and spread around medias.

Today, there is an important tool that can make consumers more willing to accept a sustainable choice: behavioural science. Thanks to behavioural science we are aware about how individuals cope with decisions and their tendency to consistently behave irrationally. The consciousness of this limitation can enable policy makers and companies to identify adequate measures to undertake in order to obtain a specific desired outcome. The implementation of an effective choice architecture, on a disruptive issue such as clean meat, in a complex context as food, that is personally relevant to costumers and where emotions play a key role, is crucial to drive consumers' behaviour. There are many factors that need to be considered in the framing of this offer, from enhancing transparency and trust on safety issues, to avoid the perception of high tech and complexity (that has been recorded to increase the perception of unnaturalness) to ultimately, improve the perception costumers have of the taste of the product.

It would be important to use educational campaigns to inform customers about the benefits of clean meat since even if, thankfully, there is a rising interest in meat substitutes and plant-based products and also more

awareness of climate change and environmental harm, often those issues are not perceived to be directly linked and dependant on livestock, at least not to the degree it actually is.

Creating more awareness and implement nudging techniques, such as a feedback system that inform customers about the amount of water or animals saved thanks to their choice for cultured meat instead of conventional meat, can represent a possible strategy. In fact, having rapid feedbacks about one's own impact on the environment has been recorded to be an incentivizing strategy for more sustainable behaviours. Of course, other factors as price is needed to be strategically implemented, but it has been confirmed that if a customer is convinced and sees the benefits of his choice, he is possibly willing to pay even a price premium.

In the framing of the offer special consideration needs to be given to cultural differences among countries. Culture, impacts people habits and attitude toward food and new products and being conscious about this relation has been found necessary to create an effective communication and to strategically decide which are the costumers to target first in order to obtain a positive reaction and a rapid diffusion. In different studies resulted that young, high income, high education individuals have the most positive approach to cultured meat and showed the strongest intention to buy the product.
It is therefore possible to suppose that, given the popularity plant-based meat substitute have gained in the U.S. , the interest of younger generation in sustainability and innovations, and the fact that Americans are the heavier meat eaters in the world, starting the distribution of cultured meat in Northern America and gradually pass to other countries could be an effective strategy.

When it comes to ethical issues raised against clean meat, it is difficult not to consider how unethical it is to continue instead with conventional farming. It is not possible to continue to raise, investing so many resources, and then condemn to death millions of animals each year only to obtain meat, considering that from the totality of the animal only a 50% is suitable for human nutrition. And to be realistic, cultured meat will not become suddenly the unique solution, there will still be the need for other alternatives as plant-based meat is, since more than one solution is needed and it is also unrealistic to think that the world population will in its totality switch to a vegan diet.

When it comes to concerns about livelihood and all the supply chain behind meat commercialization, it is clear that there will be the need for a radical change, but it is not something that will happen all in a sudden, the process will need a long period of transition in which the food industry will have time to adapt and convert to a new landscape, as it has always happened in other sectors.

Ultimately, the thesis sheds light on recent events consequent to the pandemic situation we are going through, and how once again the risk of contaminations and the spread of dangerous viruses are advantaged both in

livestock intensive farming, where animals, often of different species (situation that increases the chance for virus mutation), live in extreme conditions and then, in slaughterhouses, for their intrinsic environmental features of humidity and bacteriological load.

The hope is that from this situation, an important take away will be the necessity to change the way we approach to resources and the need for a "new normal" that include cultured meat and finally, the end of intensive farming. Maybe, this situation will work as an accelerator for this new opportunity technology has given us.

For all these reasons, humanity needs clean meat to become reality.

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SUMMARY

Today, the conjunction of a rapidly increasing population and the diffusion of several unsustainable habits, is rapidly exhausting planet resources and bringing us to a point of no return. Resource scarcity is now a global threat and not an isolated issue as it was in the past, when it was related only to some regions of the world.
To this regard, some of the biggest arguments related to this uncontrolled demographic increase, are the over exploitation of planet resources that brings to food and drinking water shortage, and the pollution produced by human activity that will unavoidably get worse as the population will continue to increase and the measures undertaken to restrain those negative consequences, will not be enough efficient. Moreover, especially in recent years the highest increase in population have been registered in the poorest region of the world, the Sub-Sharan Africa, exacerbating even more the already critical situation of hunger and misery. In this region, from the half of the 20th century to 2010 there has been an individual increase of 700 million compared to Europe were the increase was hardly reaching 200 million.

The moment when the human impact has started to be negatively significant is the beginning of the industrial revolution. Prior to the end of the 18th century, human impact was almost irrelevant and the majority of people were living in rural areas, making their living from the harvests of the land. From the industrial revolution on, population growth became much more rapid, citizens started to move toward the cities to work in factories and thanks to technological developments and innovations more resources, more rapidly were used. Today, due to the great technological improvement, industries are able to produce and exploit as never before.
Regarding exploitation of natural resource and the production of pollution from human activity, often individuals tend to underestimate the role and the impact that the food industry, especially meat production, represent. The food supply is cause of greenhouse gas emissions, unsustainable water extraction, pollution, deforestation and biodiversity loss, that in return, have negative effects on human well-being. In fact, Summing up all the direct and indirect impacts, it has been estimated that the agriculture total contribution to global emissions reaches 30% rate and of course, meat production is highly supported by agriculture. Those data are significant since our eating habits have been including every year more kilograms of meat per person and meat production is not only resource consuming, but also waste producing and among all food products, it is the most polluting. If the population will continue to increase at this rate, by the 2050 the demand for livestock products will grow by 70% which is clearly unsustainable and adding the enrichment of developing countries that brings to a nutrition transition involving an increase in meat consumption, it is necessary to find rapidly a sustainable way how to produce food and in particular meat.
In fact, even if in recent years, some developed countries have experienced a slight decrease in meat consumption, in developing countries such as China and India, despite having a history of vegetarianism, from 1970 to 1975 meat consumption has almost tripled. Moreover, in many regions of China and India water shortage is a serious difficulty and safety systems of factory farms are not ensuring the standards required to

prevent water contamination. This represents a problem given the amount of water required for livestock: in terms of water footprint it is estimated that the total water footprint of pork (as litres per kcal) is two times larger than the water footprint of pulses and four times larger than the water footprint of grains and that one thousand single-gallon jugs of water is needed to have the meat of just one chicken making meat production a clearly inefficient activity in term of resources.

The event that has worsened environmental consequences of farming has been the exponential enlargement of farms size. Before the raise of "concentrated animal feeding operations (CAFO's), farms were small, usually family-run, entities where few animals of different species were raised to produce milk, eggs and meat. But, in the U.S.A from the middle of the 20th century several policies adopted by the government has advantaged the raise of agribusiness and industrial farmers, leading to the collapse of small farmers that were not able to compete anymore and together with the development of new farming technologies, brought to the naissance of CAFO's were each day, thousands of animals can be raised and slaughtered, making meat more accessible to consumers and bringing to an increase in its consumption. Animals in those realities live in confined spaces with terrible conditions that doesn't allow their natural behaviour and are often highly unsafe exposing to the risk of water and land contamination, water pollution and the spread of dangerous viruses. The conditions under which animals are constrained to live, stress them supressing their immune system making the animals more at risk of infections and the close contact facilitates the transmission of those infections. Moreover, when different species are in close contact, it facilitates virus diffusion since it gives it the opportunity to mutate and create new strains that are more difficult to detect and cure. To avoid the spread of diseases there is the need to use antibiotics and other medications that in turn have negative consequences on human health, first of all, antibiotic resistance.
Feeding so many animals, exclusively for being slaughtered after few weeks or few months and then eaten, request enormous amount of plant resources that not only are resources that are taken from our "dishes" but that are causing massive deforestation of the rainforest, our primary source of breathable air. It is important to mention that in the EU, about two thirds of the total agricultural area is used for livestock production worldly, and, as an example, soybeans are not used only to produce soy milk, tempeh, tofu or any other fancy vegan alternative for human consumption, its main production is destinated to animals and its production needs massive amounts of land.

Having considered all of the problems conventional farming is responsible for and the raising demand for meat, it is necessary to find a way in which the existence of such realities will not be necessary anymore.
Today, there are two important alternatives to conventional meat. The first one is plant-based meat and is already on the market with some top products as the one produced by the Beyond Meat brand. Those products have reached such a high level that have been appreciated also among meat-eaters. The other, that has an even higher potential in terms of sustainability, is cultured-meat or "clean meat", that is hoped to be on the market

in the next two years. Both seems ideal substitute to combat the resources' shortage and the animal cruelty involved in meat production without making consumers to renounce to their favourite source of proteins. Among the main benefits of cultured meat there is that it would involve 45% less energy, 99% less land and 96% less water than conventional meat.

Growing meat from animal cells is not something that has been never thought about. In 1932 Winston Churchill had already commented "Fifty years hence we shall escape the absurdity of growing a whole chicken in order to eat the breast or wing by growing these parts separately under a suitable medium". And it makes perfect sense. When an animal is raised, you have to feed it to make grow the whole animal, all parts of it, and obviously there are many parts of the animal that will never be eaten. So, basically, we are investing nutrients, water and land for something that will be thrown away.

The first cultured hamburger was produced and eaten in 2013 in London, thanks to the funding of the Googles co-founder Sergey Brin to the project of Mark Post.

Mark Post, professor of vascular physiology at Maastricht University decided then to found the Mosa Meat start-up company together with Peter Verstrate in 2016, who has a background in the processed meat industry, and the team of scientist and technicians that developed the first cultured-burger.

Back in 2013 the production of that one burger cost $330.000. The work of the scientific world involved in this mission is aimed to the cut of the costs to a $11 per burger which would made it even more affordable than some conventional burgers and in 2017 they've had already managed to cut it by 80% of the initial cost.

After this first try, it was the Memphis Meat, founded by the leading cardiologist Dr. Uma Valeti and a former poultry farmer now vegetarian cell-biologist, to pursue the intent of commercialization. Till then, all others' efforts, have been focused on academic research and realization. Memphis Meat produced the first-ever lab-created meatball with the "incredibly low" cost of 1200 dollars, that in comparison with the 330.000 dollars of the first burger was a great achievement and made the dream of animal meat-free world a big step closer. In 2017 the company was able to shift from beef meat to poultry, that is the most consumed meat worldwide, and the cost of the meatball production have halved.

In the plant-based industry, when companies such as the Beyond Meat and Impossible Foods have started to produce their products there were many sceptics that such products will have the desired resonance. Today, products such as the Beyond Burger is sold in American mainstream supermarkets and when compared with the first plant-based alternatives to meat, the improvement in taste and texture have reached incredible levels. Those products are already involving technologically advanced processing and are appreciated by many consumers, therefore, there could be a chance for clean meat as well.

The plant-based food market is in continuous expansion. People are more interested in what they eat, and at the same time are more aware of the negative effects a heavy on meat diet can have and try to balance it out searching for some alternatives.

The Good Food Institute, a leader no-profit organization that promotes plant-based alternatives enhancing the collaboration between scientists, entrepreneurs and institutions, and actively supports companies that produce plant-based substitutes, has recorded that today, the plant-based market is worth 5 billion dollars in the U.S.A with an increase of 29% in the retail sales in the last two years with plant-based milk as the most established category. Currently the number of people switching for a plant-based diet despite the evidences of contribution of livestock production to environmental issues, even if growing, is still relatively moderate. In order to make those trend increase, it is crucial the flow of information delivered to consumers and the implementation of institutional policies that advantage the rise of those products. Similarly, as at the beginning dairy alternatives and plant-based meat substitutes didn't had space in consumers shopping cart, meat produced in a lab will have the opportunity to conquer consumers' trust. Fortunately, there is a raising number of consumers, especially in the higher-income classes, paying more attention to what they put in their grocery carts. An example is the rise of demand for organic food. People, despite the higher price are more interested in buying products labelled as organic because it gives them a perception of higher quality, better taste and better for their health. Whereas there are no many confirmations about the health link, it is sure that it has an impact for the environment and for the animal welfare and therefore, indirectly for human health. An organic production, use organic feed that have not been treated with any harmful chemicals and first of all is able to breed a lower number of animals since there are space standards to guarantee the welfare of the animal. But even if there was the intention to satisfy the whole food supply with organic food, with the raise of the population it wouldn't be possible due to the increased land usage, low crop yields of organic farms and a shortage of organically acceptable fertilizers. Moreover, even if all the producers around the world turned organic, the damage to the environment would still be too powerful.

The claim raised by many marketers and business experts against the clean meat feasibility under a profit point of view, is the uncertainty if in the current market situation there would be the desired acceptance and demand for the product. They claim that people are not ready to accept such a "unnatural" product after the time it took them, at least to some of them, to switch their preferences toward organic products which in contrast is giving them a higher perception of "naturalness".

Everything depends on how the product will be introduced, communicated and how the choice will be framed. The truth is that the human being is not rational and the majority of the time makes emotional choices that unfortunately, often result in poor choices. For example, in the context of food, if people were always doing perfectly reasoned and rational choices, the obesity rate wouldn't be growing at the current pace, since the existence of a perfectly rational human would assume that everyone was making the best choice to follow a healthy and balanced diet. Even if people are aware of the consequences of their actions, due to the fact that the long-term effect of a healthy life and a fitter body is usually won by the short-term effect of a savoury taste and that there is little feedback for their actions, they end-up choosing less wisely and surely less rationally.

People in the action of choosing which product to buy, usually use automatic responses and shortcuts that sometimes help, sometimes have the function of a protection and other times biases them, since they respond to the automatic way of processing the external world, also defined by the Nobel Price Daniel Kahneman, "System 1". These kinds of mechanisms arise also because individuals are highly influenced by situational factors, emotions and have behavioural schemes that make them use those shortcuts, especially when it concerns situations where they need to overcome a high level of uncertainty. This uncertainty can be due to novelty or simply due to the existence of cognitive limitations that don't allow customers to make perfectly rational choices. The rational choice that takes into account these cognitive limitations, that are unavoidably part of the decision-making process is also referred to as the human "bounded rationality". Thanks to the many research efforts that has been made in behavioural science and cognitive psychology for the comprehension of human choices, great progresses have been obtained in the range of tools that are now available to governments, institutions and companies for the design and implementation of procedures and marketing actions, focused on achieving a certain outcome in terms of individuals' choice.

One of those tools is "nudge" that is defined by the Nobel Prices Richard Thaler as follows: "A nudge is any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any option or significantly changing their economic incentives. To count as mere nudge, the intervention must be easy and cheap to avoid." It means that there are no prescriptions or economic incentives and no options are banned with a formal law, people are free to choose whatever they want but they are driven toward a better decisional process

In order to achieve the embracement of sustainable behaviour among individuals, what public institutions can do is to opt for an appropriate use of a combination of tools, preferably creating the right balance of proper information release, economic incentive and nudge, considering each time the costs, the feasibility, the importance of preservation of the right to freedom of choice and the long-term effect. It could be therefore assumed that using a combination of nudging techniques and economic incentives, can be useful to induce farmers for setting more sustainable practices in the raise of animals and in the culturing of yields, making them willing to take advantage of technological innovation that increase sustainability. Opening-up to new businesses that use technology as a beneficial tool and facilitating the encounter of farmers, scientists and distribution companies to achieve new horizons in the food area, that can contemporarily satisfies the consumers' demand and the need of preservation of our planet, should be a top of mind matter for institutions all over the world.

Several experiments have demonstrated how different food positioning in supermarkets influence the healthiness of choices. It can be supposed that putting cultured meat in strategic locations, or putting it next to some real meat items, can have a positive effect on the willingness to buy. In fact, it is what is already done in the U.S.A with the Beyond Burger that despite being a plant-based burger is located in the same section as conventional meat, just next to the beef burger. Probably it is also a way in which to encourage the trial of the

product even for non-vegetarian costumers that want to try something new and stimulate their curiosity. The proximity to a familiar product can have a positive impact on the product judgement itself since familiarity is a huge influencer on the attitude of an individual toward an item because costumers feel more at ease with something they are already used to, even if it is just visually. The simple fact of having been exposed to a brand or a product makes it more susceptible of entering subconsciously in the consideration set of a consumer.

As was mentioned above, the flow of information delivered to the costumer is crucial and to adequately promote a new product, it is useful to use some insights from the decision-process of the consumer relatively to a certain product category.

The process of decision making starts with the problem recognition when an unfulfilled need is perceived. In the case of food, it can be the perception of hunger, the perception of the need of a reward or a social situation that involves choosing among different options of food available. In this stage starts a search for information that is both external, from labels and visual cues and internal, searching in personal memory and knowledge, trying to figure out which decision will satisfy that need at its best. Since food is a low-effort decision, the search for information will be short and rapid and all this process will happen in few seconds and people will engage in established schemas that they had followed their whole life. The difference that can be faced with clean-meat, or with any food product that is innovative and new in such a disruptive way, is that it is very probable not a low-effort decision but a high involvement kind of purchase. Strong innovations follow a high-effort path and even if it is food, it is not perceived as a low-risk decision especially for associated safety issues. When a product is perceived as risky it raises the probability of encountering resistance among consumers and it seems easier and safer to continue using the familiar product. Assuming then how difficult it can be for a new product to enter the consumer consideration set, making a new product well visible with a high exposure, sharing information that are relevant to the consumer, reassuring the consumer about safety and its benefits as well as triggering both the irrational and emotional side of the consumer, can have important effects in the stage of need recognition.

Moreover not only clean meat the product is perceived as a high involvement product but, today, food has become something more than just a physiological need. For many individuals, what they eat and the diet they follow is part of their identity, is a way of communicating themselves to the world. It touches both the personal and the social aspect of someone's life. Therefore, the choice of food can reflect a particular (desired or acquired) status quo, a moral affirmation or a cultural choice. People are social beings that are never really free from the judgement of others: they tend to conform their actions to the majority of members of their social group because they want both be as their reference group and be liked by the other members. The need of a feeling of belonging to a group is strongly impacting individuals' choices. Many researches have shown how the social context in which one is consuming its meal, influence the choice of that meal.

It is necessary to create an offering in a way that makes the consumer feel in line with its goals, as a healthier and more conscious lifestyle can be and, in a broader perspective, be aware of the cultural context that can be

exerting a strong influence on him. People often use old schemas and have difficulties to be more open-minded. The role of the marketer is to nudge the consumer toward a new point of view, when the "aha" moment arises and the new choice seems the most obvious one.

It is important to make the offer easily accessible. The consumer often experiences, especially with food, the action – intention gap. This gap, means that the person had a certain intention, as it can be buying healthier food, but then reality jumps in with some unpredictable events like a bad discussion at work or traffic jam that makes him arrive late to the grocery store or in a bad mood, and the action ends up to be different from the planned intention, falling in the old automated habits. What can make the difference is making easy to access the healthier choice as was mentioned before, through the right framing. As it was initially with organic products, part of the process of making the soonest possible clean-meat a reality, is how rapidly and to which extent it will be made accessible on the market and through which distribution channels.

In the case of a new product, the company needs to educate consumers to understand the product and its advantages.

Fortunately, in the last two decades, in many developed countries an increasing demand for products that are perceived to be more "animal-friendly" such as free-range eggs have arisen. The problem is that even if organic products have to respect some higher standards than conventional products under animal welfare point of view, those standards don't exceed much the legal requirements.

Concerns and consciousness about animal welfare issues are rising, but still, it seems that there is a sort of disconnection between eating meat and considering it as an animal welfare issue. However, although the rising consciousness about the importance of animal welfare and the love toward animals, meat-eaters constitutes a majority, and they are the same individuals that loves animals and claim to respect them and would never do something cruel to them. The phenomenon that occurs is the so-called meat paradox. Meat eating includes a conflict between, on one side, the dietary preference, and on the other side, finding animal suffering emotionally disturbing. To overcome this disturbing feeling, people activate almost automatically, a process of dissonance reduction. Those findings reveal that people, especially in today more conscious society, are experiencing this moral dilemma and clean meat can be their solution.

A feature of clean meat about which consumers in different studies seemed to be more sceptical was taste. No one wants to sacrifice the taste of a real steak or burger if they can have the original one. This negative taste perception, almost disgusted, was found to be linked to the unnaturalness perceived about the product. The unnaturalness perception, brings to concerns about safety that brings to disgust, that brings to doubts about how the product will taste and therefore to the unwillingness to buy it. Therefore, delivering and communicating a good taste performance, breaking the unnaturalness barrier must be a priority.

In a study conducted in 2012 among participants from Belgium, Portugal and the UK it resulted that the most common reaction to lab-grown meat was fear and disgust, and then concerns about health and safety. Disgust, or as it has been largely defined, the "yuck" factor , was the strongest emotion that lead to a major difficulty

in giving a chance to consider the product benefits and what has arisen from the analysis of the conversations participants had after watching the video, was that the feeling of disgust was linked to the feeling of transgressing the rules of what should have been a natural product. The disgust was not linked to the content of the food but to the production process of it. The fact is that in many cases the preference for "natural" is something linked to a moral and idealistic conception rather than the effective and real instrumental side of this characteristic. Even when in front of two chemically identical products, people claim to continue preferring the "natural" one.

Therefore, considering the number of studies that confirm "unnaturalness" as a primary factor in the rejection of clean meat, identifying effective ways to describe clean meat not as a "high-tech product" may be crucial to its success. To this aim, what could be effective is start convincing consumer about the "unnaturalness" of conventional meat.

The first concept that is important to deliver to the public when it comes to cultured meat is that conventional meat is far from being natural. Once people have understood that the way animals are treated and the meat is processed and that the substances used in the process, have often nothing to do with nature there is a higher chance that they start considering clean meat as food and not as something fake and potentially harmful. Another issue to consider is that many consumers, when asked, claimed that even if they may see the benefit for the environment, they couldn't perceive the direct benefit for their own lives. It is possible that creating cues that make the benefit more concrete in the consumer mind can have positive impact on the approach to the new product.

When cultured meat acceptance has been studied among Italian consumers results were surprisingly positive. Food is part of this dynamic process and even in a country as Italy, with such a strong and long-established culinary tradition and that has made of it an important point of pride recognized worldwide, and has a deep attachment to its roots, new generations are constantly more open to different foods. However, when it comes to a disruption strong as cultured meat there can still be a high rate of rejection toward change. In 2019 in Italy has been conducted a study on consumer acceptance of a cultured burger among 525 individuals under the aspects of willingness to try it, buy it and pay for it.

The research was undertaken submitting a questionnaire with four section: the first part with sociodemographic information collection; the second part involved meat consumption habits collection, investigating whether they were or not meat eaters and about their intention to reduce meat consumption; in the third part, after having provided participants with information about cultured meat with both text and images and describing firstly the production process and then the positive impact of the product, they were asked to evaluate attributes of safeness, tastiness and nutritional value perception, and extrinsic attributes of perceived animal friendliness, the potential to stop world hunger and natural resource preservation; lastly, in the fourth part was measured participants willingness to buy, try and pay. Cultured meat resulted to be quite known among Italian consumers with 66 % of them, having at least heard of it. About the perception of cultured meat attributes, participants

were more positive toward the extrinsic attributes as animal and environmental welfare meanwhile they were quite sceptical about taste and nutritional performances when compared to a conventional burger.
In general, age, education level and geographical location impacted the perception of the products attributes meanwhile no differences were found in gender. Highly educated, younger participants (under 25) from the Northern part of Italy were appreciating more the product and recognized its potential benefit. Gender, indeed, influenced differences in willingness to try. Even if more than half of the participants stated they would try the product there was, confirming previous studies, a significant male prevalence in the willingness to do so. As for the attribute's perception, younger age and higher educational level impacted positively the intention to buy and previous exposure to information regarding cultured meat played a positive role as well. For what it concerns willingness to buy, almost half of the participants showed this intention and among those, 23% were ready to pay even a price premium. This study suggests that there is potential positive acceptance of cultured meat in Italy and that the participant perceptions are more positive towards the extrinsic than intrinsic attributes of cultured meat, confirming previous studies that show taste perception as a low performance attribute on which is necessary to work, and that the potential consumer of cultured meat includes young (under 25), highly educated and previously informed participants.

When it comes to commercialization of the product, an issue that has been largely discussed around cultured meat is terminology. Terminology is important in the framing of how things are understood. The name that is given to an object or to a product or even people's names, can influence the evaluations process and the impressions an individual will form about it. The name needs to have an easily explicative function of the product, trigger positive attitude since, before the trial moment and a deeper information seek, it is the first cue of the item with which the consumer comes in contact with.
Clean Meat has not always been the only name of this product and today the most appreciated term seems to be cultivated-meat.
Jason Matheny , the founder of the New Harvest, the world first research institute of cellular agriculture and at the same time the one thanks to which the Dutch government agency funded cultured meat research from 2005 to 2009, through media interviews detected that the first name chosen, that was "in vitro meat", even if being scientifically accurate, doesn't had a positive effect. As he stated "it is as calling table salt, sodium chloride", the effect is totally different.
The connection people immediately made when hearing the word "in vitro" was in vitro fertilization, that is definitely not a desirable image when related to something destinated to eat. There were other names tested, lab-grown meat, synthetized meat, test tube meat but all generated the same reaction of rejection. This was also the case in which the barrier of unnaturalness has been mostly detected. Then it was the turn of "hydroponic meat", since American costumers have been accustomed to hydroponic tomato and were also connecting it with a lower use of water. However, it was still too technical. In the end Matheny settled on "cultured meat" since people were already used to eat cultured foods such as yeast and yoghurt, but it was a

decision based on personal consideration without any testing on consumers. The Good Food Institute years later, in 2016, conducted a survey and the term that had major acceptance was clean meat. The term was then adopted since it was describing the fact that, in comparison with conventional meat, it was purer and uncontaminated with growth hormones, pesticides or any bacteria and it created a connection with "clean energy" making it easier to the consumer to relate to the term. But of course, the reaction of farmers were immediate, claiming the term clean to disparage conventional meat as dirty. Later, in 2019, has been detected that the term "cultivated" inspired images of agriculture and, even more important to the context, of natural processes. Moreover, it is scientifically correct and it is not used by other food types, incorporating that uniqueness characteristic that is important in product definition.

The need of standardization in terminology is necessary to solve ambiguities and to enhance consumer appeal and acceptance, as well as awareness of the product among investors and stakeholders that need a unique and clear identification mean. Moreover, it will facilitate regulatory issues and standards definition. When it comes to the role of regulators, when new technologies have to be regulated, especially when they can have consequences on human safety, governments face the important choice whether to use existing rules and analogous specifics that are more immediate but could have the risk of making those new technologies out of specific regulatory categories and being incomplete and inappropriate, or creating new ones ad hoc, that on the other side, request more time, are difficult to elaborate when the technology at hand is particularly disruptive and present uncertainties in the resulting agreement with others involved entities.

In the EU food system, cultured meat would require a pre-market authorisation, except "where the technique used falls under the scope of Regulation (EC) No 1829/2003 on genetically modified food and feed" and as well an approval by the European Food Safety Authority (EFSA).

The fact is that there is still a problem in well defining how the product should be considered. This impacts the regulation in many forms. Cell-based cellular agriculture brings together the discipline of cell culture and meat science. For what it concerns cell culture, there is a need to regulate cell sourcing and donation that are regulated only for the human context with medically oriented documents. There is the necessity to adapt those directives for cultured meat that is obviously something totally different with different use destination.

In the U.S.A., it has been argued that the regulation system follows the doctrine of "substantial equivalence": the model is used to decide whether a product of biotechnology is the equivalent to its natural counterpart. This framework seems inadequate since cultured meat should be regulated as a new product and livestock should not be considered as its the natural counterpart. In March 2018 the FDA and the US Department of Agriculture (USDA) formalized their joint agreement and announced establishing a basic framework for "human food products derived from cultured livestock and poultry cells". The FDA will regulate the initial stage of collection and growth of cultured cells, meanwhile the USDA will regulate the meat production and harvesting, including the labelling. The product will be considered meat only when it passes to the USDA regulation stage.

A category particularly interested in the regulation of cultured meat are farmers. Farmers are starting to be worried about what this will mean for their profits. In February 2018 the US Cattlemen's Association presented a petition for not permitting to products such as cultured meat, that is not produced from a raised and slaughtered animal, to use the label meat or beef. They claim that the label beef or meat should have the function of informing the consumer that the product is derived naturally from animals and not grown in a laboratory. They fear how this product will impact their profits but what they should do is to find a way, think of an improvement, an innovation how to be able to stay on the market despite clean meat, joining the technological progress.

Progress and innovation bring to changes on the market, and now it is probably the time to change something in the food industry. What can be aimed as a desirable outcome, is that clean meat will substitute meat produced in CAFO's, freeing a lot of land and animals, and at the same time, small farmers will be able to get back in the business with new conditions and their products will, hopefully, gain back higher consideration.

Today, because of this "wherever, whenever" availability of products, the value of many things is underestimated. Returning to a situation in which it is recognized the real value of raising an animal, the time necessary to raise it with natural timings and in a condition that allows its natural behaviour, will give back to the product its value. Conventionally produced meat, and here with conventionally it is meant from a raised and slaughtered animal, not an animal living in CAFO's, should, in an ideal situation, have a price premium over cultured meat and plant-based meat.

The so feared by the farming business, "substitution effect" is not likely to happen rapidly and most of all is not likely to happen at a complete level.

Furthermore, the industry of cultured meat will need the livestock sector in order to have animals raised with some specific and proper safety standards from where to take the cells for the cultivation process. It could be hypothesized that a segment of farmers will possibly become a new kind of suppliers. This would even allow them to cut management cost of their farms, since they will need less animals to raise and avoid the costs of the slaughtering process.

The job landscape in the food industry will unavoidably go under a reorganization process and together with the challenges also new opportunities will come.

Another aspect that is highly connected with regulation and terminology of a food product is, when it comes to distribution is packaging and labels. Since one of the greatest barriers that has been found in consumer acceptance toward food products produced with new technologies, as cultured meat, is the perceived unnaturalness of the product. Therefore, if there is a way in which to overcome or at least to diminish, the strength of this barrier at the point of sale with decisions concerning the packaging features, it is an aspect that should be well thought and designed. It is important that the information given about the product is clear and unambiguous in order to increase trust perception and transparency. In the case of food, providing packages that permit to see what is inside, especially when it is a new product on the market, is important to make it

easier for the consumer to understand what is it and whether he can be interested in buying it. Another aspect intrinsic to food products, is that it is an experiential good, which involves that consumers cannot try it before having purchased it and used. In fact, a part from some situations when in supermarkets there are in store free-trials, generally, whether or not a specific product is liked is known only after the purchase. It has been demonstrated that there is also a connection in the packaging design and the evaluation of the product since it can enhance both the quality perception and the potential benefit delivered by the product. When there is the desire to increase the chance that people make decisions toward a healthier and more sustainable lifestyle, the packaging needs to be in line with the product. The material used for the packaging is considered to be one of the elements that forms a part of the visual appearance and influence the way in which consumers perceive the product and infer ideas about its characteristics. Efficacious labelling could facilitate consumer choice and induce a sort of compromise in the acceptance of new technologies.

The last thing that is important to discuss, is the ethical issues raised around cultured meat. The fact is that biotechnology applied to food should be considered as the latest achievement and the natural consequences of scientific and technological development rather than something completely new. However, to those that show reluctancy toward cultured meat, what cannot be ignored, is that it also represents an incredible opportunity to reduce the harm from meat consumption. Conventional meat consumption itself raises several ethical issues, and for instance, animal advocates that are the greatest opposers to farming, even if consider plant-based diet more preferable as an approach for reducing meat consumption, many of them is favourable to the commercialization of cultured meat since it represents the ‘‘trade-off between the ideal and the practical’’ since a worldwide veganism is unrealistic and cultured meat can eliminate the need for a radical dietary change. When it comes to animal dignity of treating a part of the animal as an instrument, it is undeniable that conventional meat production treats the whole animal as a mean and not just parts of it. It will be the product of treating cells of the animal that are no-sentient beings, as a mean to satisfy people’s nutritional and pleasure-related needs and not the life of the whole living and conscious animal that is a sentient being, that will be allowed to continue with his life. People donate blood, organs and tissues and it is not considered an instrumentalization.

Looking at the current market landscape, and the day by day increasing importance that is given to social responsibility among companies, it seems that businesses have accepted that they need to take action to reduce human impact on earth by adopting new methods and taking the opportunity that new technologies are offering, to be competitive on the market. MarketsandMarkets, a global market research and consulting firm that publishes strategic analysis reports, has estimated that in 2025 the global cultured meat market will be valued 214 million dollars and will reach 593 million by 2032. Companies all around the world that have entered the cultured meat business, are working hard in order to achieve a competitive price and a high-quality product to be able to bring cultured meat on the market in a safe and accessible manner. A part from bigger

players such as the Israeli and Californian companies, there are also other smaller realities in the cultured meat business, that are trying to achieve the aim of an animal-meat free world.

Cultured meat is becoming a reality and there are many opportunities, as well as challenges, that companies can take. Especially in those latest months, the pandemic situation of Covid-19 that the world is sadly going through, has raised many issue and questions about the way we are treating our planet and as well, about the role of animal-derived food in the spread of dangerous viruses. Considering how hard it is to develop a cure or a vaccine for a new and unknown virus, it is necessary to do whatever is possible to prevent this kind of situations. And even if specifically in this case, the epidemic hasn't started in a farm, there had already been other cases such as for the SARS in 2002 in China or the BSE, commonly known as the Crazy Cow diseases, or even in 2013 the PEDv among pigs arrived from China and that caused the death or forced the kill of 10% of American pigs in the USA, that have started from animals in farms and that, as with Covid-19 that has a zoonotic origin, were then able to rapidly mutate and attack the human body with consequences that can bring to death if not properly cured.

Fortunately, in the last two months the demand for plant-based meat, has faced a significant increase. In the U.S.A since March it has been registered a 234% increased demand for plant-based meat alternatives, compared with an only 45% increase of conventional meat and the same, even if not at these rates is happening in China were the concerns about the link between animal-origin product and the virus is bringing back citizens to plant-based product and this could sign an inversion in the recent concerning trend of rising demand for meat in countries as China and India.

The opportunity that this pandemic situation will give chance for a "new normal", that will hopefully make consumers more interested in safety issues and make the acceptance of cultured meat a faster and easiest process, is the justified hope of many suppliers in the industry.